Research in Sustainable Intensification in the sub-humid maize-based cropping systems of Babati: Providing alternative integrated technologies to improve food security and income

***Africa RISING- ESA Project Proposal 2014/16***

**Babati Research Team**

**December 2014**

# Core Research Team

**Team Leader:** Mateete Bekunda, IITA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Institution | Disciplinary expertise | Theme | % time |
| Job Kihara | CIAT | Soil fertility | Crop management Efficiency | 25 |
| Stephen Lyimo | Selian ARI | Agronomy | 20 |
| Fred Kizito | CIAT | Water resources | 15 |
| Ben Lukuyu | ILRI | Animal nutrition | Improved livestock feeds | 40 |
| Leonard Marwa | TALIRI | Research methods | 100 |
| Gregory Sikumba | ILRI | Animal nutrition | 20 |
| Victor Afari-Sefa | AVRDC | Ag Economist | Vegetable integration | 7 |
| Inviolate Dominic | AVRDC | Horticulture | 15 |
| Danny Coyne | IITA | IPM | 5 |
| Adebayo Abass | IITA | Food technology | Food storage, value addition and mycotoxin management | 10 |
| Boniface Simon | IITA | Entomology | 8 |
| Gabriel Ndunguru | Consultant | Food Science |  |
| Martin Kimanya | NMAIST | Food Science | 5 |
| Bright Jumbo | CIMMYT | Crop breeding | Management of maize leaf necrosis disease | 25 |
| Dan Makumbi | CIMMYT | Crop breeding | 10 |
| Lava Kumar | IITA | Virology | 5 |
| Per Hillbur | Consultant | Human Geography | Institutional cooperation and co-learning | 30 |
| Festo Ngulu | Consultant | Agronomy | 20 |
| Jeroen Groot | WUR | Farming Systems | Farming systems analyses and impact assessment |  |
| Carlo Azzarri | IFPRI | Ag Economist |  |
| Bekele Kotu | IITA | Ag Economist | Economic validation of technologies | 20 |

Note: More research members are given at thematic level

Table of Contents

[Core Research Team 2](#_Toc406048185)

[Summary 4](#_Toc406048186)

[Action Sites 4](#_Toc406048187)

[Thematic Proposals 5](#_Toc406048191)

[Theme 1: Crop Management Efficiency 8](#_Toc406048193)

[Theme 2. Integrated Livestock Feed component (ILF) 19](#_Toc406048194)

[Theme 3.Integration of vegetables into maize-based farming systems in Babati 30](#_Toc406048195)

[Theme 4. Food storage, value addition and mycotoxin management 50](#_Toc406048199)

[Theme 5. Management of maize lethal necrosis disease 62](#_Toc406048215)

[Theme 6. Institutional Cooperation and Co-Learning 74](#_Toc406048217)

SummaryThis proposal is consolidating outputs of activities conducted during 2013-2014, merging work-package activities into themes that reflect more disciplinary integration, and describing how to achieve focus and sufficiently informed end-of-project target outputs. We have concluded baseline and farming systems, data collection and we shall be conducting comprehensive analyses of these data to operationalise typology and enable alignment with current and future research outputs and adoption studies as a means of identifying those which are attracted to a diversity of farming households.

Over 2013-14 research year, scientists continued to invest in generating data that informed the effectiveness of several integrated technologies to realize higher productivity. Results continue to show the need for intensification and integration of technologies in order to narrow the yield gaps, and the following themes that have been streamlined from last year’s work packages will guide productivity-enhancing integrated technological developments. The themes are:

1. *Crop Management Efficiency* that is mainly addressing better management of nutrients and water.
2. *Improved Livestock Feed* that is addressing increasing quality and quantity of livestock feed,
3. *Vegetable Integration* that is introducing vegetables into farming systems for improved household nutrition
4. *Food storage, Value addition and Mycotoxin management* that is addressing reduced food waste and spoilage.
5. *Management of Maize Lethal Necrosis Disease* (MLND) that is addressing management of a disease that is rapidly devastating the staple crop. Like for last year, technological integration, interactions and synergies among these themes will continue to be articulated.

Cross-cutting studies and activities that evaluate the economic potential of SI interventions and their impacts on the environment and natural resources will be embedded in the thematic activities, and so will scaling. R4D and innovation platforms will be strengthened to support impact and scaling. Data sharing, e-communication and publication strategies have improved and will be utilized better in sharing information about the project.

## Action Sites

Research will continue to be conducted in the initially selected 6 villages of Long, Sabilo, Seloto, Hallu, Matufa, and Shaurimoyo (refer to previous proposals). However, there has been special consideration for including Bermi and Gallapo villages in the study for the *Vegetable Integration* theme because of the availability of irrigation conditions that offer opportunities for a more economic off-season cropping. Accordingly, the poultry part of the *Improved Livestock Feed* theme will be extended to the same village as vegetable “wastes” are expected to contribute to the poultry feed technology development. The *MLND* thematic activities may not be confined to the selected villages; they are driven by hotspot areas that offer opportunities for testing varietal resistance.

**Consolidated budget (USD). Details are given under each WP**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Main budget category | Theme 1 | Theme 2 | Theme 3 | Theme 4 | Theme 5 | Theme 6 |
| CIAT | ILRI | AVRDC | IITA | CIMMYT | IITA |
| Personnel | 80,400 | 37,212 | 35,000 | 59,000 | 48,000 | 30,000 |
| Research | 44,400 | 80,841 | 24,800 | 79,500 | 78,000 | 20,000 |
| Training | - | - | - | 5,000 | - | 23,500\* |
| Other | 8,925 | 10,000 | 5,500 | 3,000 | 3500 | - |
| Overheads | 16,406 | 5,207 | 7,308 | - | 9750 | - |
| Totals | 150,131 | 133,260 | 72,608 | 146,500 | 139,250 | 73,500 |
| Cumulative Total | 150,131 | 283,391 | 355,999 | 502,499 | 641,749 | 715,249 |

**Notes:**

1. The cross-cutting themes of Farming Systems Analysis, M&E and Economic validation of technologies are supported independently from Research Team Budgets
2. \* includes $10K for Mateete’s LEAP student

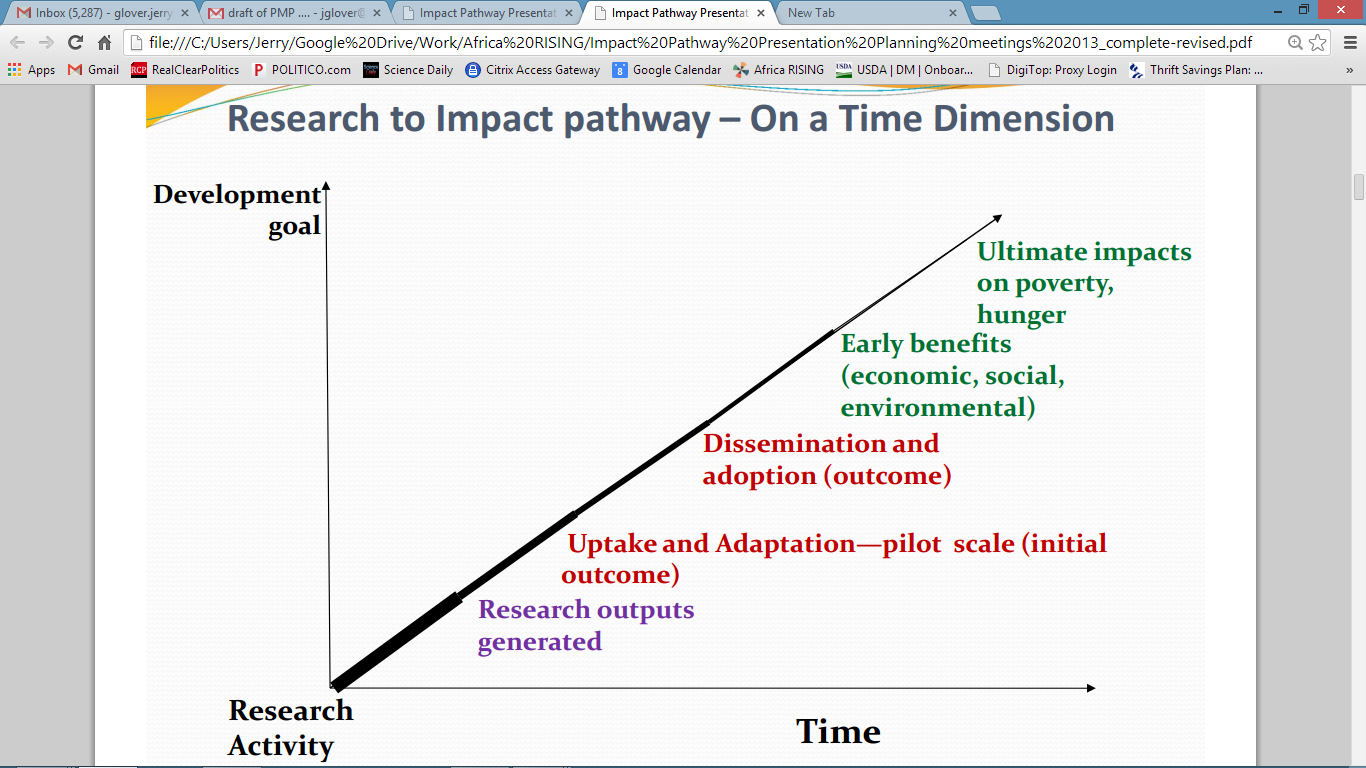
# Thematic Proposals

Following are thematic proposals in detail. During the Planning Meeting, it was agreed that proposals should follow a simpler format that excludes materials that would be repetitive to those given in past years’ proposals (e.g. site selection, communication methods). What is required was to indicate where current technology developments situate along the research-impact pathway (Figure 1 or outputs achieved in the ESA logframe), identify challenges and research activities that would move the technology to a higher level, but also guided by the ESA Project logframe, and describe the methodologies and program (activity schedule) to achieve this.

A very important component that will be concurrently conducted across all themes is the socio-economic evaluation. Technologies are promoted because they have advantages over the existing ones. The advantages of technologies can be seen from bio-physical point of view and socio-economic point of view. While these approaches have their own distinct features and analytical tools, they help to generate pieces of information which are complementary in nature regarding the performance of improved agricultural technologies. Several trials have been conducted under the different thematic areas with the aim of identifying technologies with higher bio-physical advantages than existing farmers’ practices. However, the socio-economic information about the technologies is missing as no or limited socio-economic studies have been conducted. Therefore, the purpose of this activity is to fill this gap. Socio-economic evaluation studies will:

1. Evaluate and compare profitability of technologies,
2. Analyze how the proposed technologies fit into households’ current conditions (labor requirements, timing of labor requirements, social acceptability, gender, cash requirements etc.), and
3. Monitor how the technologies are being taken up by the farmers

These activities will be addressed in two steps. The first activity will be implemented in the coming year (2015) for all relevant ongoing trials, whereas the other two activities will be addressed in the following year.The studies will partly depend on the data generated during the previous trials. Additional data will be collected as a part of the respective trials discussed in this document. The data to be collected from the bio-physical trials will constitute, among others, uses of commercial inputs (fertilizer, chemicals, seeds), labor input, draft-power input (oxen or tractor), land characteristics, outputs (grain and non-grain) and physical materials used. These data will be collected for all treatments to be included in the protocol, including the control. Moreover, secondary sources will be explored to collect data on product prices, input prices, wage rates, land use, features of farm lands, demographic characteristics, and maps of different types and scales. During the second phase of these studies, which address activities 2 and 3, interviews will be arranged with farmers to collect opinions about the technologies, understand local resource conditions, and understand how the technologies are being taken up by those who have applied them so far. The output for this plan year (2015) will be a report on profitability of a list of technologies which are being tested under different themes (particularly Themes 1 to 4) with the purpose of increasing the productivity of smallholder farmers, thereby increasing income and food security.

****

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | Cross-cutting studies (impact, markets, nutrition, gender, policy…) and actions (scaling…) | | | |
|  | | |  | C+L+S | |
|  | |  | C+L; C+S; L+S | |  |
|  | | C, L, S |  |  | |
|  |  | Baseline, FSA, Discipline surveys |  |  | |
| Hanging fruits: Team building | |  |  |  | |
| 2011-12 | | 2012-13 | 2013-14 | 2014-15 | 2015-15 |

*The dark colors show the dominant intensification activities during the action year. C, L and S represent Crop, Livestock and Soil (land) discipline activities; additions depict discipline integration. Some of the activities dominant during a given year are implemented to a lesser extent during the previous or the next year as situations dictate (e.g. emerging issues), thus the progressive reduction in color shading. Within the dark colors will be selected and refined “flag-bearer” technologies (main outputs) ready for scaling.*

**Figure 1.**The Conceptual Africa RISING activity trajectory (left). By the end of the current ESA Project phase, Research Teams should have generated “mature” integrated technologies (Research outputs following stepwise refinement – see below) some of which will have undergone adaptation trials at pilot scale.

## Theme 1: Crop Management Efficiency



Adaptation of promising crop management technologies to land and production environments in Babati, Tanzania

***1.1 RESAERCH TEAM (Theme leader: Job Kihara, CIAT)***

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name | Gender | Institution | Job title | Disciplinary expertise | Qualification. | Project role/responsibility | | % time |
| Job Kihara | Male | CIAT | Scientist | Agronomist | PhD | PI | 17 | |
| Stephen Dominic Lyimo | Male | SARI | Agronomist | Farming systems | MSc | Co-PI | 20 | |
| Fred Kizito | Male | CIAT | Scientist | Soil Scientist/ Water Resources | PhD | Co-PI | 15 | |
| Bernard Lukuyu | Male | ILRI | Scientist | Animal Nutrition | PhD | Co-PI | 15 | |
| Jetrida C. Kyekaka | Female | MAFSCO | DAICO | Horticulturalist | BSc | Advisory and follow-up field operations | 10 | |
| TALIRI | Mixed | NARS | Scientists | Multidisciplinary | Various | Collaborators | 25 | |

***1.2 SUMMARY***

During 2014/15 and 2015/16, we will (1) fine-tune manure technologies through assessment of causes of their yield limitation (2) refine N and P recommendations for maize in Babati, and (3) conduct further demonstrations of technologies for improving yields with best bet improved germplams and pigeon pea intercropping together with fertilizers, including potential for enhancing soil cover. As in the past the year, farmers will be exposed to the technologies under demonstrations. In relation to the above activities, we shall assess soil moisture variations in the crop-forage systems and investigate the role of different soil-water conservation measures as mitigation options for nutrient losses through measuring leaching, soil loss through measuring and detecting erosion and runoff. These will be followed up by conducting a landscape level assessment of associated ecosystem responses on impacts of erosion and land degradation on water quality, soil carbon storage and nutrient retention under different crop-forage systems in Babati; we shall then provide feasible scenario-based recommendations for interventions that promote sustainable intensification for crop-livestock systems and guide scaling up efforts.

**Research problem and justification**

The best bet technology of “improved germplams with pigeon pea intercropping and inorganic fertilizer” has been tested and demonstrated during the 2012/13 and 2013/14 cropping seasons and is at the uptake and adaptation stage. During 2014/15 cropping seasons, selected demonstrations will be continued in order to move this technology further towards the adoption stage. Further, our work over the last 2 years has shown potential to increase yields (reduce yield gaps) through “improved germplams with pigeon pea intercropping and inorganic fertilizer”. Therefore, 100 farmers will test this best bet practice alongside their current practice and yield improvements and economics benefits assessed. In addition, manure application, first tested in 2013/14 cropping season, did not improve maize yield. The pH of the manure was rather high, as was K content. It requires therefore, that a specific experiment be undertaken with a purposive selection of manure with known best preparation methods (including one common manure) to understand what is needed to increase crop response. Also, and because biophysical characterization work conducted in 2012/13 period identified land degradation as a common occurrence in Babati, provision of additional soil cover through lablab relay-cropped into the best bet technology of “improved germplams with pigeon pea intercropping and inorganic fertilizer” is proposed. Lablab is already doing well and in Babati offers potential to protect the soil, especially after maize harvest. This also offers an excellent opportunity of forage integration in the mainstream cropping system. In essence, this ushers in new ways of conceptualizing water and nutrient fluxes in a manner that is interdisciplinary, integrative and multi-scalar with particular attention paid to the linkages across scales. The quantification of crop responses to specific nutrients, and identifying appropriate forage options for crop-livestock integrated systems presents an inevitable need to understand systems which present opportunities for enhancing productivity and resource use efficiencies while maintaining environmentally healthy landscapes through sustainable intensification.

**Research Objectives**

1. To fine-tune crop response to combined fertilizer and manure applications
2. To test potential of relay-cropping for increased crop and land productivity within the improved germplasm and pigeon pea intercropping with fertilizer application in Babati
3. To assess the applicability of tools for site-specific fertilizer recommendations

These objectives relate to the integration, adoption and trade-off framework hypotheses of AR in that they will integrate improved varieties, fertilizers and organic resources within established cropping systems and coupled with considerations of affordability. Further, the technologies are tested in varied soil and climate conditions and lessons can be easily applied to other similar contexts and thus addressing scalability hypothesis.

In addition to the above objectives, there are other NRM related objectives that build on work conducted in 2013-2014 because field monitoring and assessment of these trends helps justify the impact of the various proposed technologies in co-located sites with the crop-fertilizer and the forages work highlighted above and intends to:

1. Assess soil moisture variations in crop-forage systems;
2. Evaluate the role of proven soil-water conservation measures to mitigate nutrient and soil loss;
3. Conduct landscape level assessment of associated ecosystem responses on impacts of erosion and land degradation on water quality, soil carbon storage and nutrient retention under different crop-forage systems in Babati;
4. Provide a feasible scenario-based recommendations for interventions that promote sustainable intensification for crop-livestock systems and guide scaling up efforts.

***1.3 METHODOLOGY***

1. **Manure demonstration trials**

Manure was first integrated in the ISFM trials during 2013/14 cropping season but performed poorly. During 2014/15, a specific trial will be set-up in Seloto to test manure prepared varied. We will have 4 sets of manure treatments (manure from chairman Seloto, and 3 preferred manure from 3 other farmers within Babati). These will be tested alone (as done by farmers and at a mean rate of 3.5t/ha) and also in combination with Minjingu-Mazao at recommended rate. A control treatment without fertilization will also be included. Thus, in this manure trial, there will be a total of 9 treatments (Table 1) that will be replicated 3 times. Each manure used will be fully characterized to explain observed responses. The selection will ensure that well prepared manure by farmers within Babati is tested. In addition to this trial, a farmer technology assessment will be undertaken and training on appropriate manure and compost preparation conducted.

Table 1. Treatments in manure trial in Seloto village

|  |  |
| --- | --- |
| T1 | Control |
| T2 | Manure 1 |
| T3 | Manure 2 |
| T4 | Manure 3 |
| T5 | Manure 4 |
| T6 | Manure 1 +Minjingu Mazao |
| T7 | Manure 2 +Minjingu Mazao |
| T8 | Manure 3 +Minjingu Mazao |
| T9 | Manure 4 +Minjingu Mazao |

1. **Improving soil cover in maize pigeon pea intercropping with Minjingu-mazao**

The best bet technology of “improved maize and pigeon pea intercropping with Minjingu-Mazao” requires further refinement to provide more soil cover after the maize is harvested. Soil cover remains a key challenge to soil and water conservation in Babati because most farmers remove all the crop residues after harvesting. Seloto provides an appropriate climate for relay-cropping of lablab at about maturity stage of maize. Lablab is well established in Matufa village, but, has not yet been incorporated in the maize-pigeon pea intercropping system. Lablab performs well when planted as forage (in intercropping with napier) and it is important to get it integrated in the common maize-pigeon pea intercropping system of Babati. Therefore, a trial of our matured improved maize-pigeon pea intercropping with Minjingu-Mazao will be tested together with relay cropping of lablab. This will have 4 treatments: control (i.e., the matured technology), control with lablab at half population, with full population, with full population established 3 weeks earlier than in other treatments.

Table 2. Treatment in relay-cropping in Seloto village

|  |  |
| --- | --- |
| T1 | Best bet technology |
| T2 | As T1+lablab at half population relay-cropped at 10 weeks after planting |
| T3 | As T1+lablab at full population relay-cropped at 10 weeks after planting |
| T4 | As T1+lablab at full population relay-cropped at 7 weeks after planting |

Using the manure demonstration trials and the relay-cropping trials for the crop management work package, we shall conduct tied-ridges as a proven technology for soil-water conservation. Soil moisture variation (measured with diviner 2000 probes), nutrient losses (measured with suction lysimeters) and erosion, soil losses (estimated using overland flow runoff detectors which can be measured with non-recording overland flow detectors made of aluminum cubes (15cm by 15cm)).

The relay-cropping trial in Seloto serves as an ideal case where NRM, crop and forage integration will be brought to the fore and test these feasibility of the associated technologies. Overland flow detectors will be monitored following rain events to determine the presence or absence of runoff. Runoff water samples will be collected from the detectors and analyzed for NO3-. The soils in these trials will also be characterized for pH, texture, water holding capacity, bulk density, CEC, and C & N contents. The quantities and quality of the applied manure will be recorded on a regular basis. In addition, tension lysimeters constructed by attaching ceramic cups (Soil Moisture Corp., Goleta, CA) to a 1-1/4inch diameter polyvinyl chloride (PVC) pipe tube sealed at the end with a rubber stopper will be installed in pairs, one at 50cm and the other at 100cm depth and placed at upper, mid and lower slopes of the farm. One lysimeter pair will be installed at each distance. Leachate samples will be collected regularly throughout the growing season for measurement of NO3- levels.

In collaboration with the work on forages, we shall assess root depths and canopy characteristics of the different forage species at plot level while measuring soil moisture variations. This will then be scaled up to landscape level through scenario generation on forage land use changes and their associated fluxes i.e. runoff, sediment and water quality. In addition, we shall evaluate the influence of topography (different slope categories) on the fluxes e.g. sloping lands vs flat areas in order to provide a suite of case-specific intervention options for the crop-forage intensification with different slope categories in Babati.

1. **Selected continuation and exposure of best-bet ISFM to farmers**

Demonstrations of farmer-preferred maize varieties using best-bet ISFM practices (i.e., variety trials) will be continued in 4 villages where this system is most preferred (Long, Seloto, Sabilo and Hallu) and will involve 4 demonstrations per village). This is at the uptake and the adaptation stage in the research to uptake trajectory. Two farmer field days and farmer technology assessments will be conducted to sensitize farmers further on this technology. Unlike in previous years, two improved maize varieties (those that performed best in the just ended season) identified for best performance (priority ones being PAN691 and SC 627 in “Long” and SC627 and Pioneer 3253 in the other villages will be used in the demonstrations. Each maize variety will be intercropped with the improved pigeon pea variety *Mali* (a long maturing variety) at the inter-row spacing recommended for each agro-ecozone. The fertilizer treatments/sources are as in previous season, namely: 1) Minjingu Mazao in intercropped system, 2) Minjingu Phosphate Rock (Minjingu Granular) with maize pigeon peas intercropping; 3) Di-Ammonium Phosphate, DAP (18%N, 20%P, 0%K); 4) 3t FYM/ha (quite affordable by many farmers in Babati) + Minjingu Mazao; and 5) 6t FYM/ha alone (option for farmers with more manure). The P rates applied from each fertilizer source will be 20kg/ha at planting. A total of 60kg N/ha (with supplementation from Urea) will be the target for all the fertilizer treatments. The plot size for each treatment will be 7m x 7m.

In addition, 100 farmers will test a sub-set of this matured technology against their local practice. A student from Makerere University will be engaged in this and other uptake/adaptation activities to provide further understanding of the constraints and potential challenges that need to be addressed.

The fertilizer trials (called response trials conducted in 2013/14 cropping season and which are at the research stage in the trajectory) have shown a lot of variability in responses to fertilizers across the fields in Babati, with some fields not responding at all and others responding highly. A selection of the N and P response trials will be continued (2 farmer fields in each of the 4 villages) to refine the responses in those responsive fields. There is no need to fine-tune responses in non-responsive fertile fields.

Table 3. Number and fields to be continued in 2014/5 according to the set-up of 2013/14 season

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Components\village** | **Long** | **Seloto** | **Sabilo** | **Hallu** |
| Trial type 1 | 2  (Lulu and Hillary) | 2  (Rosalia $ Sisti) | 2  (Zadakiya, Stanslaus) | 2  (Simon, Tumaini and Quawanga) |
| Trial type 2 | 2  (Lulu and Hillary) | 2  (Rosalia $ Sisti) | 2  (Zadakiya Pombo, Nicodemus Stanslaus) | 2  (Simon and Benjemin Quawanga) |

The associated NRM field measurements will include the assessment of crop-forage system impacts on water and nutrient fluxes through measuring erosion, leaching and runoff to waterways. To address this objective which contributes to managing crops and livestock production at landscape levels of representative farms currently being used for crop productivity trials and for improved forages will be used as monitoring test beds. These farms are located in Seloto, Long, Sabillo and Hallu as exemplified in Table 3 above.

1. **Modeling and Scaling**

We intend to use the APEX (Agricultural Policy Extender) Module within SWAT to inform on smaller scale processes which will in turn help in predicting larger scale nutrient dynamics in the Babati landscape, including N-loading in adjoining water bodies as a result of fertilization and integration of improved forages under different land cover types. Data captured from the different crop and forage systems will form the basis for parameterization of the Soil and Water Assessment Tool (SWAT) modeling platform.

Land use/remote sensing-derived maps (used as inputs for SWAT) will be used to determine spatial patterns from specific areas for measurements of stream water quality based on delineations of predominant landscape level activities. This will cover, for example downstream of irrigation areas, grazing lands, high intensity cropping lands and forested areas. Samples will be collected at monthly intervals over the whole year to capture temporal patterns in the cropping calendar and the associated activities. The samples will be analyzed for silt, N load, and common chemical residues. This activity will thus involve acquisition and analysis of freely available remote-sensing images to derive up to-date land use maps, data collection in the specified locations which serve as pre-requisites for the landscape level water, nutrient and soil flow modeling. This modeling component will also integrate the spatially-defined management data such as the manure application on farmer-fields as captured in the agronomic survey conducted by WP1 last year (and what will be collected this year). We will also utilize rainfall data being collected in the different villages to relate rainfall with erosion prevalence.

In addition, we shall conduct linkage analyses of the modeled results that relate the farm level to landscape scale interactions. The fluxes from water movement induce surface runoff, sediment movement and deposition from upslope areas to the subsequent downslope regions (will be quantified by the modeling). In addition, conceptual interventions are proposed (based on scenario outcomes from the modeling) that relate to crop-water-livestock interactions from the farm level to landscape scale. Critical to this process, both biophysical and socioeconomic scales need to be matched for effective uptake and impact. Vertical scaling-up through the extension of ideas and management processes across stakeholder groups (through community level meetings to discuss perceptions) and institutions, as well as policy makers to private sector interests will be explored in coordination with the other work packages. Ideally, this will take place through the field days in a simplified visual mode that communicates informative messages. This will be complemented by biophysical-socioeconomic tools (InVEST and RIOS) that incorporate landscape process with stakeholder preferences.

1. **Communication and dissemination strategies**

Besides capacity building among extension and farmers in Babati, results of the research will be presented in scientific forums and published in peer reviewed journals. Extension materials will also be prepared in collaboration with other partners working on the same theme in the district

***1.4 FtF INDICATOR TARGETS***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Indicator / Disaggregation | | | Baseline | 2013 | | | 2014 | |  | | 2015 | | 2016 | |
| Target | | Actual | Target | | Actual | | Target | | Target | |
| 4.5.2(2):Number of hectares under improved technologies or management practices as a result of USG assistance (RIA) (WOG) | | |  | 0 | | 0 | 15 | | 11 | | 30 | | 40 | |
| Technology type | | |  |  | |  |  | |  | |  | |  | |
| crop genetics | | |  |  | |  |  | |  | |  | |  | |
| pest management | | |  |  | |  |  | |  | |  | |  | |
| disease management | | |  |  | |  |  | |  | |  | |  | |
| soil-related | | |  |  | |  | 15 | | 11 | | 30 | | 40 | |
| irrigation | | |  |  | |  |  | |  | |  | |  | |
| water management | | |  |  | |  |  | |  | |  | |  | |
| climate mitigation or adaptation | | |  |  | |  |  | |  | |  | |  | |
| other | | |  |  | |  |  | |  | |  | |  | |
| total w/one or more improved technology | | |  |  | |  |  | |  | |  | |  | |
| Disaggregates Not Available | | |  |  | |  |  | |  | |  | |  | |
| New/Continuing | | |  |  | |  |  | |  | |  | |  | |
| New | | |  |  | |  |  | |  | |  | |  | |
| Continuing | | |  |  | |  |  | |  | |  | |  | |
| Disaggregates Not Available | | |  |  | |  |  | |  | |  | |  | |
| Sex | | |  |  | |  |  | |  | |  | |  | |
| Male | | |  |  | |  | 11 | | 9.4 | | 23 | | 30 | |
| Female | | |  |  | |  | 4 | | 1.6 | | 7 | | 10 | |
| Joint | | |  |  | |  |  | |  | |  | |  | |
| Association-applied | | |  |  | |  |  | |  | |  | |  | |
| Disaggregates Not Available | | |  |  | |  |  | |  | |  | |  | |
| 4.5.2(5):Number of farmers and others who have applied new technologies or management practices as a result of USG assistance (RIA) (WOG) | | |  | 0 | | 0 | 50 | | 35 | | 100 | | 400 | |
| New/Continuing | | |  |  | |  |  | |  | |  | |  | |
| New | | |  |  | |  | 50 | | 35 | | 100 | | 300 | |
| Continuing | | |  |  | |  |  | |  | |  | | 100 | |
| Disaggregates Not Available | | |  |  | |  |  | |  | |  | |  | |
| Sex | | |  |  | |  |  | |  | |  | |  | |
| Male | | |  |  | |  | 35 | | 30 | | 70 | | 300 | |
| Female | | |  |  | |  | 15 | | 5 | | 30 | | 100 | |
| Disaggregates Not Available | | |  |  | |  |  | |  | |  | |  | |
| 4.5.2(7):Number of individuals who have received USG supported short-term agricultural sector productivity or food security training (RIA) (WOG) | | |  | 400 | | 480 | 600 | | 401 | | 500 | | 700 | |
| Type of individual | | |  |  | |  |  | |  | |  | |  | |
| Producers | | |  |  | |  | 600 | | 401 | | 500 | | 700 | |
| People in government | | |  |  | |  |  | |  | |  | |  | |
| People in private sector firms | | |  |  | |  |  | |  | |  | |  | |
| People in civil society | | |  |  | |  |  | |  | |  | |  | |
| Disaggregates Not Available | | |  |  | |  |  | |  | |  | |  | |
| Sex | | |  |  | |  |  | |  | |  | |  | |
| Male | | |  |  | |  | 450 | | 284 | | 350 | | 500 | |
| Female | | |  |  | |  | 150 | | 117 | | 150 | | 200 | |
| Disaggregates Not Available | | |  |  | |  |  | |  | |  | |  | |
| 4.5.2(11):Number of food security private enterprises (for profit), producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) receiving USG assistance (RIA) (WOG) | | |  | 0 | | 0 | 0 | | 0 | | 0 | | 0 | |
| Type of organization | | |  |  | |  |  | |  | |  | |  | |
| Private enterprises (for profit) | | |  |  | |  |  | |  | |  | |  | |
| Producers organizations | | |  |  | |  |  | |  | |  | |  | |
| Water users' associations | | |  |  | |  |  | |  | |  | |  | |
| Women's groups | | |  |  | |  |  | |  | |  | |  | |
| Trade and business associations | | |  |  | |  |  | |  | |  | |  | |
| Community-based organizations (CBOs) | | |  |  | |  |  | |  | |  | |  | |
| Disaggregates Not Available | | |  |  | |  |  | |  | |  | |  | |
| New/Continuing | | |  |  | |  |  | |  | |  | |  | |
| New | | |  |  | |  |  | |  | |  | |  | |
| Continuing | | |  |  | |  |  | |  | |  | |  | |
| Disaggregates Not Available | | |  |  | |  |  | |  | |  | |  | |
| 4.5.2(12):Number of public-private partnerships formed as a result of FTF assistance (S) | | |  | 0 | | 0 | 0 | | 0 | | 0 | | 0 | |
| Agricultural production | | |  |  | |  |  | |  | |  | |  | |
| Agricultural post harvest transformation | | |  |  | |  |  | |  | |  | |  | |
| Nutrition | | |  |  | |  |  | |  | |  | |  | |
| Multi-focus | | |  |  | |  |  | |  | |  | |  | |
| Other | | |  |  | |  |  | |  | |  | |  | |
| Disaggregates Not Available | | |  |  | |  |  | |  | |  | |  | |
| 4.5.2(27):Number of members of producer organizations and community based organizations receiving USG assistance (S) | | |  | 0 | | 0 | 0 | | 0 | | 0 | | 0 | |
| Type of organization | | |  |  | |  |  | |  | |  | |  | |
| Producer organization | | |  |  | |  |  | |  | |  | |  | |
| Non-producer-organization CBO | | |  |  | |  |  | |  | |  | |  | |
| Disaggregates Not Available | | |  |  | |  |  | |  | |  | |  | |
| Sex | | |  |  | |  |  | |  | |  | |  | |
| Male | | |  |  | |  |  | |  | |  | |  | |
| Female | | |  |  | |  |  | |  | |  | |  | |
| Disaggregates Not Available | | |  |  | |  |  | |  | |  | |  | |
| 4.5.2(39):Number of new technologies or management practices in one of the following phases of development: (Phase I/II/III) (S) | | | The phases are not aggregated | | | | | | | | | | | |
| Phase 1  Number of new technologies or management practices under research as a result of USG assistance | | |  | | 0 | 0 | | 1 | | 1 | | 1 | | 1 |
| Phase 2  Number of new technologies or management practices under field testing as a result of USG assistance | | |  | | 0 | 0 | | 2 | |  | | 3 | | 2 |
| Phase 3  Number of new technologies or management practices made available for transfer as a result of USG assistance | | |  | | 0 | 0 | | 0 | |  | | 0 | | 0 |
| Disaggregates Not Available | | |  | |  |  | |  | |  | |  | |  |
| 4.5.2(42):(4.5.2-28) Number of private enterprises (for profit), producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) that applied new technologies or management practices as a result of USG assistance (RIA) (WOG) | | |  | | 0 | 0 | | 0 | |  | | 0 | | 0 |
| Type of organization | | |  | |  |  | |  | |  | |  | |  |
| Private enterprises (for profit) | | |  | |  |  | |  | |  | |  | |  |
| Producers organizations | | |  | |  |  | |  | |  | |  | |  |
| Water users associations | | |  | |  |  | |  | |  | |  | |  |
| Women's groups | | |  | |  |  | |  | |  | |  | |  |
| Trade and business associations | | |  | |  |  | |  | |  | |  | |  |
| Community-based organizations (CBOs) | | |  | |  |  | |  | |  | |  | |  |
| Disaggregates Not Available | | |  | |  |  | |  | |  | |  | |  |
| New/Continuing | | |  | |  |  | |  | |  | |  | |  |
| New | | |  | |  |  | |  | |  | |  | |  |
| Continuing | | |  | |  |  | |  | |  | |  | |  |
| Disaggregates Not Available | | |  | |  |  | |  | |  | |  | |  |
|  |  |  |  | |  |  | |  | |  | |  | |  |

**1.5 *BUDGET (USD) FOR 2014/15***

|  |  |  |  |
| --- | --- | --- | --- |
| **Description** | **CIAT** | **Selian** | **Total** |
| A.Staff time |  |  |  |
| Scientists | 52,500 | 15,000 | 67,500 |
| Field allowances | 6,700 | 6,200 | 12,900 |
| ***Sub-total*** | ***59,200*** | ***21,200*** | ***80,400*** |
| B. Other direct costs |  |  |  |
| Travel/motor vehicle use/hire | 14,100 | 6,200 | 20,300 |
| Plant and soil processing & shipping | 800 |  | 800 |
| Plant and soil analyses | 2,100 |  | 2,100 |
| Supplies and communication | 3,200 | 5,000 | 8,200 |
| Field monitoring, characterization and equipment maintenance | 6,000 |  | 6,000 |
| Scaling up and field days |  | 7,000 | 7,000 |
| ***Sub-total*** | ***26,200*** | ***18,200*** | ***44,400*** |
| Research and Technical support (RTS) Sub-total | **8,925** |  | **8,925** |
| **Sub-total** | **94,325** | **39,400** | **133,725** |
| C. Indirect costs (Sum of overhead at 14%) | 13,206 | 3,200 | 16,406 |
| **D. Total direct and indirect costs** | **107,531** | **42,600** | **150,131** |

* 1. ***ACTIVITY SCHEDULE UPTO 2016***

******

|  |  |  |  |
| --- | --- | --- | --- |
| **Activities** | **Objectively verifiable indicator (OVI)** | **Means of**  **verification (MOV)** | **Lead Responsibility** |
| 1.2.1 Soils, agronomic, livestock, food and feed surveys in key sentinel sites identify biophysical constraints | i) Area maps showing biophysical and socioeconomic factors contributing to land degradation processes produced  ii) Intervention maps that scale to landscape level rolled out | i) Report on area maps produced by Dec 2015  ii) Map book on intervention maps produced by Dec 2015 | CIAT, IITA, AVRDC, MSU, ICRISAT, SIMLEZA, ILRI |
| 4.1.1 Engage partners at appropriate levels | i) Tailored workshops for capacity building of R4D actors where farmers will be trained on good agronomic practices, ISFM technologies and appropriate manure management in conjunction with R4D team conducted | i) Report on capacity building for scalable and feasible technologies produced by Dec. 2015 | CIAT and R4D team |
|  |  |  |  |
| 6.1.1 Test ecologically and economically sound integrated nutrient management practices for enhanced productivity without detrimental effects on the environment | i) 2 manure quality improvement technologies identified and promoted in 4 Africa RISING villages in Babati  ii) 25 farmers in Babati trained on good practices of manure management and composting  iii) Nutrient management recommendations for N and P based on soil and crop responses and profitability assessments refined  iv) Impact of relay to improve soil cover in best bet ISFM practices of improved maize germplasm with pigeon pea intercropping and inorganic fertilizers identified  v) Preferred P sources that are economically proven demonstrated, evaluated and adapted by up to 100 farmers  vi) 4 crop management practices and varieties economically validated  vii) Scaling approaches for mature improved maize, pigeon peas and P sources identified and utilized (Field days and technology assessments (2 field days))  viii) Soil and water conservation measures extended to at least 50 farm families  ix) Scaling for nutrient retention and soil loss mitigation assessed for other farms outside of the study focus. | i) Guidelines for efficient fertilizer and manure and application practices produced by March 2016  ii) Report on field protocols in water and nutrient management at farm and landscape scales produced  ii) Report on economic analyses | CIAT, WUR, IITA and AR Economists |
| 6.2.1 Test ecologically and economically sound integrated land and water management practices for enhanced productivity without detrimental effects on the environment | i) Calibrated functional models that showcase water and nutrient processes from farm scale to landscape produced  ii) Validated options for integration of soil and water conservation practices in cropping systems produced.   * In-situ water harvesting and erosion control (relay-cropping; tied-ridges) * Combinations of promising complementary technologies   + e.g. crop residue management + fertilizers + in-situ water harvesting   iii) Scenario options for sustainable intensification produced  iv) 2 integrated water and soil conservation practices economically validated | i) Report on calibrated functional models produced  ii) Publication on validated options and scenario options  iii) Report on economic analysis | CIAT, ICRAF, WUR, IITA and AR Economists |

***1.7 LOGICAL FRAMEWORK: Expected results/deliverables***

## Theme 2. Integrated Livestock Feed component (ILF)

Fodder and feed as a key opportunity for driving sustainable intensification of crop livestock systems in Tanzania

***2.1 RESEARCH TEAM (Theme leader: Ben Lukuyu, ILRI)***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Name | Gender | Institution | Job title | Disciplinary expertise | Qualification | Project role | %  time |
| Peter Thorne | Male | ILRI | Principal Scientist | Livestock scientist | PhD | ILRI, Africa RISING Coordinator | 2 |
| Bernard Lukuyu | Male | ILRI | Scientist | Animal Nutrition | PhD | Lead Scientist | 40 |
| Leonard Marwa | Male | Africa RISING | PhD. Student | Research Methods | MSc. | PhD Student, Field coordinator | 100 |
| Gregory Sikumba | Male | ILRI | PhD. Student | Animal Nutrition and production | MSc | PhD student | 20 |
| Alphonce Haule | Male | ILRI | MSc. Student | Tropical Animal Production | BSc | MSc Student | 100 |
| N.N. | Mixed | TALIRI, Kilimanjaro West | Scientists | Multidisciplinary | Various | Collaborators | 20 |
| Bekele Hundie Kotu | Male | IITA | Agricultural Economist | Agricultural Economist | PhD | Economic analysis | 5 |

***2.2 SUMMARY***

This proposal focuses on forages and feed as a key opportunity for driving sustainable intensification of crop livestock systems in Tanzania. In 2013-2014, the livestock component was divided into two work packages (i) Screening and integrating forages in systems and improved use of crop residues and (i) developing feeds for indigenous poultry from local feed resources. In 2014-2015, the two work packages have been merged into an integrated livestock feeds component (ILF) to enhance integration. This component is designed to have three sub components as follows:

1. The first sub component revolves around screening forages, testing them with farmers and integrating them into existing farming systems.
2. The second sub component is enhanced integration of crop residues in smallholder farms through improved storage, processing and utilization for ruminants.
3. The third sub component is concerned with improved management and feeding strategies with emphasis on utilization of local feed resources for indigenous poultry.

Our activities from 2012-2014 have focused on generating research outputs, i.e. improved forage species. By 2014 a number of the outputs are ready for use by farmers. In the year 2014-2015, the proposal seeks to disseminate and promote and promising forage species and varieties. The proposal also seeks to continue with both on station forage screening and participatory action with farmers’ to mature technologies that are still under research, such as more forage options, feed choppers, rations for poultry and ruminants; and also to initiate integration activities on selected farms. It is hoped that the integrated livestock feed activities for 2014-2015 will contribute immensely towards intensification mixed crop-livestock systems in Babati district through improved feed supply and land management hence increased milk production and reduced environmental degradation.

***2.3 JUSTIFICATION***

Livestock has a multiple potential to enhance the sustainable intensification in mixed crop-livestock systems, while mitigating climate change and reversing environmental degradation. A problem diagnosis at the inception of the project using the FEAST tool clearly identified three main livestock constraints in Babati district (Sikumba *et al.* 2014). The included (i) absence of improved forages which is aggravated by lack of information about forages and feeds in generals. (ii) Abundance of crop residues (14% of the total feed diet) available during harvest season are poorly stored, utilized and go to waste. (iii) There is no supplementation using balanced diets despite the abundance of locally available feed resources such as legume and cereal by products due to crop production dominance in the system. These problems are exuberated by strong seasonal feed variations that result into farmers meeting about 55% of their feed needs under the best conditions. Our livestock component designed interventions in 2013-2014 to (i) integrate improved forages into smallholder crop-livestock systems as a land management/feed strategy and enhance processing and utilization of crop residues (previously work package 3) and to also improve utilization of locally available feed resources to enhance productivity of indigenous chicken (previously work package 8). In this year’s proposal, we have endeavored to integrate the activities of the two former work packages into one proposal while clearly defining activities and matching them to our major outputs.  
 **Forages**

The year 2012-2013 was committed to the on - station screening of selected forages based on expert analysis of their biophysical characteristics match to agro ecological zones. Clear ‘best bet’ forages emerged from this study, including ILRI 16835 and Kakamega 2 that yield 10 and 20kg DM/ha respectively. The rest of the varieties ILRI 16803, ILRI 16837, ILRI 14984 and Kakamega 1 recorded average yields 7-10kg DM/ha. Given these results a decision was made to test all the Napier grass varieties with farmers in 2013-2014. In addition, two outstanding varieties of herbaceous legumes (*Desmodium uncinatum* and *Lablab purpureum)* and fodder trees and shrubs *Leucaena pallida* and *Leucaena diversifolia* were also selected for on-farm testing.

In the 2013-2014 on farm testing, intercropping trials of maize – *desmodium* or *lablab* intercrops, Napier grass – *desmodium* or *lablab* intercrops and their controls were set up on selected farms in the study sites. Fodder trees and shrubs were planted on trials across the gradient in all experimental plots. The trials demonstrated clear benefits in terms of biomass quantity and quality at varying levels in different agro ecological zones (AEZs). In long, Kakamega 2 and ILRI 16835 were identified as best bests, in Sabilo, Kakamega 2 and ILRI 16837, In Long all varieties were suitable as best bets except ILRI 16803. Meaning farmers have a variety of Napier grass variety options to choose from depending on their needs. We hypothesize positive benefits in the ongoing measurements of soil characteristics study. The lessons and feedback from the trials show that we have a limited choice of herbaceous legumes given the diversity in the farming systems and farm typologies. Although we have demonstrated potential benefits of Napier grasses there is necessity to extend this screening to other grass types. Overall, the need to integrate forages and demonstrate benefits at farm level is our next focus.

**Crop residues**

The livestock component aims to improve the storage, processing and utilization of crop residue strategies of farmers in Babati district. In order to achieve this, an MSc. Student is assessing types, quantity, quality, post-harvest handling and use of crop residues and other local feed resources for livestock in Babati district. The study is currently ongoing. The information obtained will enable formulation of total mixed rations (TMR) for livestock in Babati in 2014-2015. To improve on crop residue utilization, the component fabricated three feed choppers (manual, diesel and electric) for testing with farmers. The testing will cover both efficiency of processing and effect on feed quality as well as the efficiency of the machines themselves, with a view of developing a feed processing model as well as using the machine to enhance the TMR concept (feed quality).

**Indigenous poultry**

Finally, the livestock component aims to integrate indigenous chickens in mixed crop-livestock farming systems through improved management and use of local feed resources. The ongoing doctoral study has already evaluated types and quality of local feed resources. The key findings show that more than 90% of chicken are left to scavenge while there is abundant cheap by products – cereals, legumes, and vegetables etc. that are not efficiently used to feed indigenous chickens. The most used energy feed ingredients include maize grain, maize bran, sorghum grain, rice and rice polish. While the commonly used protein source ingredients were sunflower seed cake, blood and fish meals. Other locally found potential chicken feed ingredients found in Babati but not used by farmers are pigeon pea, *Leucaena* leaf meal, *Moringa* leaf meal, *Lablab purpureus* and soya bean. Most of the available local feeds, especially cereals are spoilt and of poor quality and will require post-harvest handling strategies before being in cooperated into the livestock feed chain. Our focus for next year will include formulating indigenous chicken rations based on locally available feed resources, developing strategies to process and handle these feed resources post-harvest and testing with farmers.

***2.4 REQUIREMENTS TO MATURE TECHNOLOGIES: (high level integration), principles, data generated, expressed in context (cross cutting disciplines)***

**Forages**

The forage varieties and suitable for various agro ecological zones were selected in 2013-2014. The strategies for 2014-2015 are as follows:

* In the current study sites (Sabilo, Long and Matufa) where activities are ongoing, the focus will be to integrate the forages in existing farming systems on 6 farms representing 3 different farm typologies. This will include on-farm forage trials (more forage options – inclusive of new CIAT material) + different treatments (monocrop, interrupt, different input levels etc.) The aim will be to showcase ‘best bet’ Napier grass and legume varieties along with proven fertilizer and maize technologies on one farm in an integrated manner.
* Expanding on-farm forage trials with more forage options and different treatments to three new project villages using bulking plots and the test farmer approach being used in current trials

Specific activities will include:

1. Determine quantity and quality of forage varieties and various treatments
2. Evaluate impacts of improved forages on farms (feed availability, manure quantity and quality, etc.) Convert the figures into a unit that's usable by farmers, e.g. land area required for how for various forages to support X number of cows
3. Determine cost and benefits of forage technologies

The outputs from these activities should clearly define potential ‘best bet’ forages or combinations of forages for different ecologies and recommendations on how these could be integrated with other improved technologies into existing framing systems of Babati district. As a result, 2015-2016, will be committed to scaling up and out packaging of these technologies and promoting them through the across stakeholder groups (through village level meetings to discuss uptake) and institutions, policy makers, private in coordination with the other relevant work packages. The channels of dissemination will include field days, R4D platforms and planned meeting with all stakeholders. The activities for 2015-2016 are not budgeted for in this proposal.

**Crop residues**

An ongoing study will provide knowledge on the available types of crop residues and their estimated quantities in the system. This study is being conducted as part of an MSc thesis. Forage choppers and a Stover baler were fabricated locally in collaboration with a government training institute – CARMATEC and tested on the farm during farm visits of project stakeholders. In 2014-2015, the focus will be:

1. To refine the machines together with fabricators and do more on farm testing with farmers
2. To determine the economics, affordability and effect on forage quality and use of forages choppers and baler
3. Formulate total mixed rations based on locally available crop residues for cattle and determine their quality
4. Determine the performance of these rations with cattle on three farms in three villages
5. Determine the cost and benefits of these rations

These activities will enable us to mature three technologies that will be ready for promotion in 2015-2016. These are:

1. Local tested and adapted forage chopping machines that match the farmer needs and whose performance is optimal
2. Local tested and adapted forage baler that match the farmer needs and whose performance is optimal
3. At least three total mixed rations for ruminants

These technologies will be promoted in 2015-2016 through field days, R4D platforms and planned meeting with all stakeholders - (these activities are not budgeted for in this proposal). In addition, we expect to generate an MSc thesis and a journal paper from this work.

**Indigenous poultry**

A number of diagnostic activities were completed in 2013-2014. These enabled the livestock component to:

* Characterize the production and feeding systems and identify value chain actors of indigenous chickens in Babati and surrounding areas
* To identify potential local feed resources and those currently used by farmers to feed indigenous poultry and their interaction with seasonality in Babati district
* To determine nutritional quality the feed resources

This component also linked with IITA lead food and feed safety component to assess mycotoxin contamination the poultry feed ingredients and compounded feeds. The focus for 2014-2015 will be to:

1. Formulate total mixed ratios based on locally available feed resources based on nutritional requirements of indigenous chickens
2. Determine the effects of supplementation with these rations on growth and egg production in the free-range systems of Babati district
3. Determine the cost and benefits of these rations
4. Develop packages for enhancing knowledge of the promising feed ration options

These activities will enable us to mature one technology and develop an indigenous chicken feeding package that will be ready for promotion in 2015-2016. These are:

1. At least two total mixed rations for indigenous chickens each targeted to different growth stages

We shall also produce an indigenous chicken feeding package pamphlet and train extension personnel. In addition, we expect to generate a PhD thesis and a journal paper from this work.

***2.5 THEME LOGFRAME (Addressing Activity 5.2.1 of the ESA Logframe – Introduce and evaluate new livestock breeds and management practices)***

|  |  |  |  |
| --- | --- | --- | --- |
| **Narrative summary**  **(Outputs)** | **Objectively verifiable indicator (OVI)** | **Means of**  **verification (MOV)** | **Lead**  **Institutions** |
| 2.2 Appropriate feed conservation methods for forages and crop residues developed | 1. A crop residue (CR) baler tested and evaluated with farmers and recommendation for use produced. 2. Cost benefits of CR baler determined and reported 3. Feed conservation strategies evaluated | 1. Report on improved baling for crop residues produced. 2. Benefits and economic of baler disseminated through a leaflet on use. 3. A report on potential use of different feed conservation methods produced. 4. At least 50 farmers trained. | ILRI, TALIRI West Kilimanjaro and Government extension |
| 2.3 Balanced rations for ruminants | 1. Study to determine available types of crop residues and their estimated quantities in the system completed. 2. At least two total mixed rations formulated for different classes of cattle and tested on a least 6 farms. 3. Cost and benefits of balanced rations for ruminants determined and reported | 1. A report on balanced rations for ruminants based on local feed resources produced. 2. Leaflet on ruminant ration balancing produced. | ILRI, TALIRI West Kilimanjaro and Government extension |
| 2.5 Balanced rations for indigenous chickens | 1. At least two total mixed rations formulated for different classes of cattle and tested on at least 6 farms. 2. Cost and benefits of balanced rations for indigenous chickens determined and reported | 1. A report on balanced rations for indigenous chickens based on local feed resources produced. 2. Leaflet on indigenous chickens ration balancing produced. | ILRI, TALIRI West Kilimanjaro and Government extension |
| 2.6 Appropriate feed processing machines developed | 1. Three types of feed choppers tested and evaluated with farmers and recommendation for use produced. 2. Cost benefits of choppers determined and reported. | 1. Report on improved feed choppers produced. 2. Benefits and economic of the choppers disseminated through a leaflet on use. | ILRI, TALIRI West Kilimanjaro and Government extension |
| 2.7 Indigenous chicken production systems and their constraints defined | 1. Factors hindering development of indigenous chickens identified. | 1. A report indigenous chicken production systems and their constraints. | ILRI, TALIRI West Kilimanjaro and Government extension |
| 3.2 High yielding forage species for different AEZ’s | 1. In existing sites, showcase the integration of forages into existing systems in different AEZs and along with other proven technologies. 2. On new sites, at least two high yielding forage varieties under Babati conditions identified and reported by September 2015. | 1. A report on the integration of forages into existing systems produced. 2. A report on new high yielding forage options in new sites identified. | ILRI, TALIRI West Kilimanjaro and Government extension |
| 4.1 Best bet forage species and varieties economically evaluated | 1. The costs and benefits of 2 best bet forages under test determined. | (i) A report on the costs and benefits of 2 introduced forages. | ILRI, TALIRI West Kilimanjaro, Government extension, AR economist |
| 4.6. Cost benefit of rations for ruminants and chicken | 1. The costs and benefits of all formulated rations for ruminants and chicken determined. | (i) A report on the costs and benefits of all formulated rations for ruminants and chicken. | ILRI, TALIRI West Kilimanjaro and Government extension |
| 5.2. Capacity building for all technologies for farmers and extension staff | 1. A package for enhancing knowledge on ruminant ration balancing produced. 2. A package for enhancing knowledge on indigenous chickens ration balancing produced. 3. A leaflet on utilization of crop residues disseminated. | 1. At least 50 farmers trained on the use of crop residue baler. 2. At least 50 farmers trained on the use of feed choppers. 3. At least 50 farmers trained on the importance of ruminant ration balancing and feed supplementation. 4. At least 50 farmers trained on the importance of indigenous chickens ration balancing and feed supplementation. 5. At least 50 farmers trained on forage production. | ILRI, TALIRI West Kilimanjaro and Government extension |
| 6.5 Scaling up of screened promising forage species and varieties | 1. Planting material disseminated to farmers in the three villages where bulking sites were set up. | 1. Planting materials distributed to at least 50 farmers | ILRI, TALIRI West Kilimanjaro and Government extension |

***2.6 ACTIVITY SCHEDULE 2014/15***

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Progress indicators (Objectively verifiable indicators - OVI) | Nov-14 | Dec-14 | Jan-15 | Feb-15 | Mar-15 | Apr-15 | May-15 | Jun-15 | Jul-15 | Aug-15 | Sep-15 | Oct-15 |
| 2.2 Appropriate feed conservation methods for forages and crop residues developed | | | | | | | | | | | | |
| 2.2.1.A crop residue baler tested and evaluated with farmers and recommendation for use produced. |  |  |  |  |  |  |  |  |  |  |  |  |
| 2.2.2.Cost benefits of CR baler determined and reported. |  |  |  |  |  |  |  |  |  |  |  |  |
| 2.2.3.Feed conservation strategies evaluated. |  |  |  |  |  |  |  |  |  |  |  |  |
| 2.3 Balanced rations for ruminants | | | | | | | | | | | | |
| 2.3.1.Study to determine available types of crop residues and their estimated quantities in the system completed. |  |  |  |  |  |  |  |  |  |  |  |  |
| 2.3.2.At least two total mixed rations formulated for different classes of cattle and tested on a least 6 farms. |  |  |  |  |  |  |  |  |  |  |  |  |
| 2.3.3 A package for enhancing knowledge on ruminant ration balancing produced. |  |  |  |  |  |  |  |  |  |  |  |  |
| 2.3.3.Cost and benefits of balanced rations for ruminants determined and reported. |  |  |  |  |  |  |  |  |  |  |  |  |
| 2.5 Balanced rations for indigenous chickens | | | | | | | | | | | | |
| 2.5.1.At least two total mixed rations formulated for different classes of cattle and tested on a least 6 farms. |  |  |  |  |  |  |  |  |  |  |  |  |
| 2.5.2.A package for enhancing knowledge on indigenous chicken ration balancing produced. |  |  |  |  |  |  |  |  |  |  |  |  |
| 2.5.3.Cost and benefits of balanced rations for indigenous chickens determined and reported. |  |  |  |  |  |  |  |  |  |  |  |  |
| 2.6 Appropriate feed processing machines developed | | | | | | | | | | | | |
| 2.6.1.Three types of feed choppers tested and evaluated with farmers and recommendation for use product. |  |  |  |  |  |  |  |  |  |  |  |  |
| 2.6.2 Cost benefits of choppers determined and reported. |  |  |  |  |  |  |  |  |  |  |  |  |
| 2.7 Indigenous chicken production systems and their constraints defined | | | | | | | | | | | | |
| 2.7.1.Factors hindering development of indigenous chickens identified. |  |  |  |  |  |  |  |  |  |  |  |  |
| 3.2 High yielding forage species for different AEZ’s | | | | | | | | | | | | |
| 3.2.1 Integration of forages into existing systems in different AEZs and along with other proven technologies demonstrated in existing sites. |  |  |  |  |  |  |  |  |  |  |  |  |
| 3.2.2 At least two high yielding forage varieties under Babati conditions identified and reported. |  |  |  |  |  |  |  |  |  |  |  |  |
| 4.1 Best bet forage species and varieties economically evaluated | | | | | | | | | | | | |
| 4.1.1.The costs and benefits of all forages under test determined. |  |  |  |  |  |  |  |  |  |  |  |  |
| 4.6 Cost benefit of rations for ruminants and chicken | | | | | | | | | | | | |
| 4.6.1.The costs and benefits of all formulated rations for ruminants and chicken determined. |  |  |  |  |  |  |  |  |  |  |  |  |
| 5.2 Capacity building for all technologies for farmers and extension staff. |  |  |  |  |  |  |  |  |  |  |  |  |
| 6.5 Scaling up of screened promising forage species and varieties. |  |  |  |  |  |  |  |  |  |  |  |  |

***2.7 ACTIVITY OUTLINE FOR 2015/16***

It is forecasted that there will be roll over activities stemming from 2014/15. The actual forms of those will depend very much on the outputs and outcomes of planned activities. However, a broad outline of activities for mature technologies in 2015/16 is summarized below.

|  |  |
| --- | --- |
| Sub component | Activity |
| Forages | 1. Developing a package of integration of forages into existing systems 2. Scaling up of screened promising forage species and varieties 3. Capacity building for forage production for farmers and extension staff |
| Crop residues | 1. Scale out a package on crop residue based ration formulation through participatory action research to generate evidence for follow up dissemination activities 2. Capacity building for crop residue utilization for farmers and extension staff |
| Enhanced feeding of indigenous chickens | 1. Scale out a package on crop residue based ration formulation through participatory action research to generate evidence for follow up dissemination activities 2. Capacity building for crop residue utilization for farmers and extension staff |

***2.8 BUDGET (USD) FOR 2014/15***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Item description | | Unit | Unit cost | Total cost |
| Admin | Ben Lukuyu (40%) | 40% | 468 | 18,720 |
| Peter Thorne (2%) | 2% | 746 | 1,492 |
| Research Technician (50%) | 50% | 350 | 17,500 |
| ICT Service Charge | 35% |  | 1,225 |
| Space Charge | 35% |  | 950 |
| Research Coordination (15%) | 15% | 20,212 | 3,032 |
| **Sub Total** |  |  | **42,419** |
| Research | Activity 1 | 6 | 5157 | 30,942 |
| Activity 2 | 3 | 5900 | 17,700 |
| Activity 3 | 1 | 6000 | 6.000 |
| Activity 4 | 3 | 8733 | 26,199 |
| **Sub total** |  |  | **80,841** |
| Partner | TALIRI | lump sum |  | **10,000** |
|  | **Grand total** |  |  | **133,260** |

***2.9 FTF INDICATOR TARGETS 2014/15 AND 2015/16***

|  |  |  |  |
| --- | --- | --- | --- |
| **Indicators** | **Year 2013/14** | **Year 2014/15** | **Year 2015/16** |
| *2.2. Feed conservation methods for forages and crop residues.* | *-* | *100* | *350* |
| *2.3 Balanced rations for ruminants* | *-* | *100* | *350* |
| *2.5 Balanced rations for indigenous chickens* | *-* | *100* | *350* |
| *2.6 Feed processing machines.* | *-* | *100* | *350* |
| *3.2 High yielding forage species.* | *54* | *200* | *500* |
| *Number reached through field days* | *267* | *700* | *500* |
| *Number reached through participatory variety assessments.* | *87* | *100* | *250* |
| *Number reached through participatory assessment of fodder chopping and baling technologies.* | *408* | *100* | *350* |
| 4.5.2(5): Total number of farmers and others who have applied new technologies or management practices as a result of USG assistance (RIA) (WOG) |  | 1500 | 3000 |
| 4.5.2(7): Total number of individuals who have received USG supported short-term agricultural sector productivity or food security training (RIA) (WOG) |  | 67 | 57 |
| 4.5.2(11): Number of food security private enterprises (for profit), producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) receiving USG assistance (RIA) (WOG) |  | 2 | 4 |
| 4.5.2(12): Number of public-private partnerships formed as a result of FTF assistance (S) |  | 2 | 2 |
| 4.5.2(39): Number of new technologies or management practices in one of the following phases of development: (Phase I/II/III) (S) |  |  |  |
| Phase I:Technology under research |  | 12 | 12 |
| Phase II: Technology under field testing - validation / adaptability tests |  | 12 | 12 |
| Phase III: Technology made available for transfer - dissemination/up scaling |  | 18 | 18 |

## Theme 3.Integration of vegetables into maize-based farming systems in Babati

***3.1 RESEARCH TEAM (Theme leader: Victor Afari-Sefa, AVRDC)***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Name** | **Gender** | **Institution** | **Disciplinary expertise** | **Qualification** | **Project role** | **% time** |
| Victor Afari-Sefa | M | AVRDC | Agricultural Economist | PhD | Scientist | 7% |
| Tsvetelina Stoilova | F | AVRDC | Genetic Resources | PhD | Scientist | 3% |
| Inviolate Dominic | F | AVRDC | Horticulturalist | MSc candidate | Research Assistant | 15% |
| Philipo Joseph Lukuman | M | AVRDC | Agricultural Economist | BSc | Research Assistant | 10% |
| Danny Coyne | M | IITA | IPM on vegetables | PhD | Scientist | 5% |
| Mary Maganga | F | IITA | ISFM | MSc | Research Assistant | 10% |
| Bekele Kotu | M | IITA | Agricultural Economist | PhD | Economic analysis | 2% |

***3.2 SUMMARY***

Traditional African vegetables can make an important contribution to food and nutritional security and enhance the livelihoods of marginal and smallholder farmers as is currently being demonstrated within the integrated farming systems project of the Africa RISING Eastern and Southern Africa project in Babati, Tanzania. Baseline socioeconomic survey results augmented by community sensitization efforts and on-farm demonstration trials indicate that: (i) elite vegetable varieties, particularly those released from AVRDC’s germplasm, (ii) healthy seedlings, and (iii) integrated crop and pest management compared to business-as-usual (standard) farmer practices enhance production under good agricultural practices and offer a promising scope to improve production. Demonstration plots have particularly been used as training and learning centers and the means to disseminate the technologies within the four project communities and neighboring locale. Results from preliminary harvest data show a staggering 700% improvement on the standard 12metre square plots when using healthy seedling treatments compared to farmer-grown (non-healthy) seedlings, with even more improvement when the use of healthy seedlings were combined with good agricultural practices (GAP). As yield and cost and return data are yet to be finalized for all four project villages, a major effort of R&D activities for this research theme will focus on a repeat of the demonstration trials to validate data and create greater awareness of the benefits of such interventions. Therefore, this research theme will first build on earlier work, particularly from the 2013/2014 season, to provide the needed cost-benefit analysis of good agricultural practices to enhance production. In addition, the agronomic, profitability and food safety aspects of the vegetable integration and diversification into existing farming systems will be further investigated. Also, efforts for both 2014-2015 and 2015-2016 production seasons will focus on postharvest training of benefiting farmers, integration of vegetables in combination with poultry production, as well as water uses optimization management practices and harvesting, particularly in communities that are not well endowed with irrigation facilities.

***3.3 RESEARCH OBJECTIVES***

The specific research objectives are to:

1. **Validate data for already introduced improved varieties.** We shall validate and disseminate best-bet management packages around the most promising farmer selected new crop varieties (*Tengeru 2010* tomato, *Madiira I* amaranth and *Tengeru white* African eggplant) suited to semi-arid agro-ecological zones. Over the next two production seasons, emphasis will be on validating the yield and cost and return data for these varieties. In line with the integration hypothesis of the Africa RISING program, this output will contribute to Research Objective 2 (and partially to Objective 3) of the Africa RISING program.
2. **Introduce and evaluate improved varieties of additional vegetables or species of same crop type in cereal-based farming systems.** We shallexplore opportunities for other varieties of amaranth and introduce new varieties of sweet pepper and Ethiopian mustard to be selected by benefiting farmers. The purpose is to increase the pool of diverse vegetables that offer enhanced productivity and horticultural traits while conferring resistance to biotic and abiotic stresses as well as cultural acceptability of selected nutrient-dense varieties for enhanced nutrition. This objective will contribute to Research Objectives 1 and 2 of the Africa RISING program.
3. **Integrated crop and pest management practices & food safety analysis.** Evidence so far from the pest and disease survey and from assessments conducted on demonstration plots show that themajor vegetable diseases are Early blight, Late blight, Bacterial wilt, Bacterial spots, Tomato yellow leaf curl Virus (TYLCV) and root-knot nematodes. Major insect pests observed in the field were Whiteflies and Leaf minor. Major damage from these diseases were seen on demonstration plots managed by farmers. It was also noted that farmers did not apply manure and fertilizer at an establishment so stunted growth was obvious accompanied with disease, infection and insect pest infestation accentuating the damage on crops. A field manual on the identification and management of pests and diseases was produced and translated to the Swahili language by IITA and distributed to extension officers and some lead farmers in the project communities. Further laboratory analysis is still pending from a second round of samples collected for analysis that will be validated in the 2014-2015 production season. In addition, detailed integrated crop and pest management (ICPM) recommendations for the various crops will be developed once laboratory analysis has been completed and validated in the 2014-2015 production season. We will continue with field and laboratory diagnosis of diseases and recommend ICPM packages most suited for farmers over the next two production seasons. We shall be on the lookout for *Tuta absoluta,* a tomato pest that is fast becoming a threat. A critical intervention envisaged in this activity, as observed from the previous season, is the production, use and demonstration of healthy seedlings. This needs to be maintained to fully ingratiate farmers for the benefit of using healthy seedlings. It is essential that farmers wishing to take this on board are provided with support and guidance to ensure that their seedling production is of healthy seedlings, and not seedling production of ‘unhealthy’ seedlings. This is a concern given that a number of farmers have shown enthusiasm and taken the initiative to produce seedlings for use and sale, but are not employing the standards required to produce healthy seedlings, such as were used in the demonstrations in the 2013/2014 production season. Failure to oversee and support this will undo any gains made on the use of and awareness of healthy seedlings in 2014. The objective will make a direct contribution to safe and sustainable intensification of mutually beneficial mixed cropping systems (Objectives 1 and 2 of the Africa RISING program) through a participatory problem analysis and intervention strategy development process involving stakeholders and research and development actors. Participatory identification and mapping of pest and disease problems, which are critical bottlenecks to vegetable production and marketing for sustainable intensification of horticultural value chains in association with maize in the targeted district, can be realized. At the same time detailed data for outcome evaluation on farmers’ fields in the 2015-2016 production season and ultimately for a project wide impact study the M&E team will be realized through this activity. Results will be used to develop and strengthen key partnerships, responsibilities to deliver a time-bound set of activities, outputs, outcomes and impacts in the subsequent season to increase the adoption, efficiency, and safety of vegetable production and consumer access to safer vegetables. Results from the project can subsequently be adapted to other cereal-vegetable based systems within Tanzania and across East and Southern Africa (Africa RISING Research Objectives 2 and 3).
4. **Market linkages and validated postharvest processing and utilization practices for enhancing produce shelf-life**. As part of targeted training, farmers will be empowered to enable access to market information through skills in farm business and entrepreneurship. Particular emphasis will be placed on involving women farmers as technical innovators, resource managers and homemakers and developing their capacity, particularly in the area of postharvest handling and processing. This objective will contribute to Research Objective 2 of the Africa RISING program.
5. **Vegetable-poultry integration and productivity enhancement**. The emphasis on this activity will be on optimal combinations of resources aimed at using chicken waste (droppings) to replenish the fertility status of soils cultivated to vegetables while exploring the use of vegetable residue (waste) as poultry feed. This objective will contribute to improving household food and nutrition security via the homestead food production models being tested by several organizations such as Hellen Keller International, among the most vulnerable households, but with an additional focus on nutrient recycling (with inputs from the natural resource management research theme) and to Research Objective 2 of the Africa RISING program.
6. **Water harvesting and management practices:** Water access is critical for vegetable production, particularly during the off-season. Research activities will be conducted on efficient water application on crops under standard macro-irrigation practices of farmers. Water harvesting techniques that can be applied during the rainy seasons would be introduced to farmers to enable them to conserve water for use during the dry season. This will include the use of shallow wells as well as sensitization and training on the effective use of water as applied in various micro-irrigation practices used by farmers, such as drip irrigation techniques for deployment on small areas of land. This optimises the use of water. This will contribute to Research Objectives 1 and 2 of the Africa RISING program.
7. **Promote nutritional education on the need for increased consumption of vegetables:** Targeted nutritional promotion campaigns will be conductedaimed at meeting the World Health Organization (WHO)’s daily recommended requirement of 200g of vegetables per capita per day. Results from the baseline survey study and subsequent interaction with beneficiaries during the community sensitization and the community farmer field days held in the 2013-2014 production season generally suggests the need for strong promotional campaigns to make farmers aware of the nutritional importance of increased vegetable consumption, and to promote home gardens as a source of vegetables that can diversify diets for all household members. This will contribute to Research Objective 3 the Africa RISING program.

***3.4 METHODOLOGY***

|  |
| --- |
| This will be an action research, awareness creation and capacity building activity for farmers and Agricultural Extension Agents. Activities will be continued in the villages of Matufa, Seloto, Bermi and Gallapo in the 2014-2015 production seasons. Bermi and Gallapo villages were originally not within the selected Africa RISING program villages but are now included due to their vegetable growing potential (as observed during the site selection exercise), particularly the availability of water for irrigation and for the purpose of hastening program impact in the future. In the 2015-2016 production season, water harvesting and management techniques will be tested in Long village for possible integration of vegetable-poultry activities under the livestock and feed research theme. We also intend to validate data collected on demonstration trials in the 2013-2014 production seasons through a repetition of the trials in the 2014-2015 production seasons. As an extension to the activities of the previous season however, we would while introduce and evaluate additional improved varieties of vegetable crops (i.e., amaranth, Ethiopian mustard and sweet pepper) and where applicable other promising vegetables in existing c-based systems to farm households in a manner that complements their on-going farm enterprises and contributes to household nutrition and diversified income outcomes. In the 2015-2016 production season, demonstration trials will be extended to include poultry integration (i.e., use of poultry droppings on the productivity of vegetables and complemented by testing of vegetable residue as poultry feed to be led by the *livestock and feed research theme*) but more emphasis would be placed on scaling-out of validated results of the demonstration trials on elite vegetable varieties, healthy seedlings, recommended ICPM packages and water harvesting and management techniques in the four project communities and selected spillover ones in collaboration with other upcoming AVRDC initiatives in the study area and beyond. The following activities are proposed over the next two years.  ***Pre-season stakeholder meetings with partners and beneficiaries for community mobilization*:** Led by AVRDC, the activity will involve providing feedback on lessons learnt from the 2013/2014 season and share planned work for the 2014-2015 and 2015-2016 production seasons. Efforts will be done to mobilize more women to participate in technology validation and experimentations so as to balance gender involvement in activities, particularly demonstration trials and training programs.  ***Additional community sensitization efforts and complementing field demonstrations for farmer participatory selection of additional vegetables varieties:***In addition to the three already selected preferred varieties of tomato, amaranth and Africa eggplant, farmers would be encouraged to select additional improved varieties for more resistance to identified pest and diseases so far identified on demonstration plots and farmer fields. This will include amaranth and new varieties of sweet pepper, Ethiopian mustard (or other vegetable types that may be of further interest, either commercially or for home consumption) on demonstration plots. As species are selected consideration will be given to the need to incorporate knowledge of managing other crops for better crop rotation practice and use of residue as poultry feed supply. Scaling out of tested and preferred varieties from the 2014-2015 production seasons will be the main focus in the 2015-2016 production season. This will be undertaken in collaboration with AVRDC’s likely upcoming three-year scaling up intervention on vegetable home gardens as well as the proposed Africa RISING scaling up project. The activity will be led by AVRDC.  ***Repeat of demonstration trials of preferred and selected varieties of tomato, amaranth and, African eggplant:***As usual best bet practices will be based on use of healthy seedlings and basic improvements in crop production practices which reduce pest and disease incidence and increase production. Demonstration sites will continue to create awareness of these practices, while assessment of their agronomic performance and economic benefits will be compared with those from standard farmer practice plots as detailed above. |
| Following earlier community sensitization efforts to create more awareness on the nutritional and economic importance of integrating vegetables into the maize-based farming system in Babati district, workable action plans for the best possible outcomes, building on an existing initiative to reconnect production, marketing and enhance increased consumption of vegetables in project communities with possible spillover effects to and neighboring ones were implemented. As of February, 2014,it was realized that adoption had increased from the initial 71 trained farmers to 140 in total *(37 from Bermi; 38 from Seloto; 35 from Gallapo and 30 from Matufa)* in project villages. A key element of the GAP packages introduced was the evaluation of the benefit and demonstration of the use of healthy seedlings. At the time of reporting it was estimated that over 400 direct and indirect farmers are currently benefiting from the knowledge transfer from the community sensitization, training and demonstration trials established. Consequently, the demonstration plots for 2013-2014 will be repeated in the 2014-2015 production season for the purpose of obtaining consistent results. Also, in order to test the robustness and sensitivity of the yield and cost and return analysis data obtained from the previous season, crops will be planted in different seasons in order to gain sufficient variation in datasets, given the sensitive and perishable nature of vegetables in response to climate variables. In the 2013-2014 production season, for example, a total of 209 farmers was known to have visited demonstration plots during field days in the four project communities for earning purposes. In the 2014-2015, efforts will be made to strengthen cross-community learning using exchange visits to demonstration plots in various communities with subsequent scaling up to other neighboring communities as part of Research Objective 3 of the Africa RISING project in the 2015-2016 production season. The activity will be led by AVRDC but with strong inputs required from IITA on healthy seedling management and ICPM.  ***Pest and disease management:*** The 2012-2013 production season scoping studies recorded a high incidence of pests and diseases with farmers reporting wilting, chlorosis, necrosis, viral disfigured leaves and pests as the most prevalent and disturbing diseases in the surveyed regions. Chlorosiswas mostly seen in tomato and maize, necrosis was common in African eggplant, amaranth and tomato while maize was rarely affected. Results from our baseline survey on pest and disease incidence indicated that pest and disease incidence contributed to yield reduction by 47.5% for African eggplant, 20.8% for sweet pepper, 19.5% for maize, 18.8% for tomato and 17.1% for amaranth. Results from the 2012-2013 production seasons’ socio-economic scoping study also indicated that just 40% of vegetable farmers reported having applied pesticides on their vegetable fields, out of which only 17% reported using any protection gear when applying pesticides. Also, the majority of respondents (65%) applied pesticides after recognising the pest symptoms in the vegetable field, while a smaller proportion reported their application at regular intervals during a season (15%) with very few (only 2%) reported pesticide application after field sampling was done. In essence, numerous knowledge gaps in pest and disease awareness and understanding was observed which needed to be addressed in the 2013-14 production season. Results from the pest and disease assessment on demonstration plots from the 2013-2014 production season also revealed poor crop management practices including soil and water management and poor understanding and management of pest and disease infections such as fungal blights, nematodes, viral diseases, thrips, and whiteflies, among others, in farmers’ fields that need to be addressed. A poor awareness of the causes of pest and disease symptoms that farmers observe was found to be related to difficulties in understanding how to manage these, while a poor understanding of pesticides and which ones to use was seen as further accentuating the problems, and indeed creating a separate problem around pesticide use. Results from preliminary harvest data show a tremendous improvement when using healthy seedling treatments compared to farmer-grown (non-healthy) seedlings under farmer standard practice with even more pronounced improvement when healthy seedlings were combined with GAP. Thus, appropriate ICPM of vegetable pests and diseases will reduce the misapplication of pesticides that are harmful to human, animal and environmental health. This can be achieved through interventions that focus on the key pest and diseases that were identified in the surveys in the 2013-2014 production seasons. While the existing production manual will be distributed to additional extension officers and lead farmers, continued deployment/demonstration of varieties resistant against the prominent constraints and improved agronomic practices to minimize infection, spread and impact of pests and diseases will be conducted for results to be compared, assessed and evaluated. Where pesticides are necessary, guidance will be provided on appropriate products, timing and dose of application (pre- and postharvest). Farmers will also be trained on best use of agricultural inputs, including pesticides, for better management of diseases and pests as well as addressing sanitation issues related to good harvesting practices of vegetables. Appropriate ICPM of vegetable pest and diseases will be finalized and disseminated to reduce the misapplication of pesticides that are harmful to human, animal and environmental health. The activity will be led by IITA.  ***Cost-benefits analyses on integrated intercropping systems for adaptability tested:*** To ensure that introduced technologies are widely adopted by farmers, it is again important to undertake a profitability analysis of the incremental changes in existing practices by farmers so as to compare them to standard farmer practices. Thus, farmers must be able to visualize the economic benefits of the proposed technologies, including vegetable-cereal crop intercropping and crop rotation trials. Partial budgeting analysis approaches would be used to assess the economic profitability of promising technologies and cropping options to enhance adoption. Data collection for the 2013-2014 production seasons is in progress and will be finalized by the end of October 2014. As enumerated earlier, the demonstration trials would be repeated in the 2014-15 production season to obtain a second set of cost and return analysis data. Results will be shared with farmers during community sensitization days as well as via the Babati R4D platform that was set up in 2014, for widespread adoption. In addition, elite varieties deployed for adaptability will also be tested for possible adaptability by intercropping them with staples. An MSc. Student from Sokoine University is also undertaking his thesis work in this area by examining how newly introduced vegetable related technologies have contributed to vegetable yield and farmers’ returns vis-à-vis standard farmer practices. In addition, an assessment of the spillover effect of the introduced technological interventions on crop diversity, crop concentration and dietary patterns and gender analysis will be undertaken. The proposed MSc. study is expected to be completed in April 2015. The activity will be led by AVRDC.  ***Vegetable seedling unit established at community level:***Field observations and results from the demonstration trials set-up in the 2013-2014 production season show a high demand for seeds (and particularly healthy seedlings) of AVRDC’s elite improved cultivars that were provided to farmers as start-up kits following successful training. In response to the overwhelming demand for elite and healthy cultivars, some farmers had even set up their own nurseries to sell to other farmers. This observation is not surprising given the tremendous increases in yields of up to 700% on a 12metre square demonstration plots compared to standard farmer practices based on preliminary data. In the 2014-2015 season, it is proposed that a community based nursery system will be established where farmers will be instructed and guided on good agronomic husbandry practices, including use of specialized nursery trays using the farmer learning group (FLG) concept already tested and validated by IITA in West Africa. Selected farmerswill accordingly betrained in the quality declared seed system so seeds could be formally certified for sale within the project district and applicable agro-climatic zones in accordance with the Tanzania Official Seed Certification Institute (TOSCI). This will require a close collaboration with TOSCI, which has already collaborated with AVRDC, CABI, HORTI-Tengeru and other national partners in Central Tanzania. This will also ensure farmers that will be using own-saved seeds in the subsequent season could be confident of the quality of seeds stored for that purpose. We propose to establish one seedling unit per each project community. Given that this requires a fairly large initial financial investment beyond the scope of the allocated budget, this activity is anticipated to attract collaborative attention from the Tanzanian Agricultural Productivity Program (TAPP) who has indicated interest in the development of such healthy seedling production units. The activity will be led by IITA.  ***Water harvesting and management practices:***In collaboration with the natural resource management research theme, we will explore options for effective water harvesting in the four vegetable related project communities as well as in Long and Sabilo villages. This would mainly occur in the 2015-2016 production season. Research activities will also be geared towards evaluating water use efficiency of existing farmer micro-irrigation systems for recommended improvements to save water. In addition, efforts will be made to strengthen existing farmer groups and/or facilitate the establishment of new ones as appropriate to improve their bargaining power and access to inputs such as water and credit access as well as coordination of sale of produce to access high-value output markets. This activity will be coordinated by AVRDC but with expected strong inputs from CIAT as well as IITA, funds permitting.  ***Awareness creation and training in postharvest handling practices*:** In the 2013-2014 production seasons, efforts and resources were adjusted to place more emphasis on technology transfer via on-farm demonstration plots as we later got a better feeling of how critical this was. Thus training targets for postharvest handling were not fully met as a result and will therefore be continued in the 2014-2015 and 2015-2016 production seasons. Through such targeted training programs in the upcoming production seasons, beneficiary farmers will be made to understand the factors which contribute to high postharvest losses in vegetable production and marketing. This will lead to reduced seasonal gluts and shortages and enhance year-round availability of produce for sale and increased home consumption. Training activities will be conducted specifically on postharvest handling of vegetables to enhance produce shelf-life while ensuring year-round availability of vegetables including utilization via training on cooking recipes. To this end, special emphasis will be placed on ensuring availability of nutrient dense vegetables for women and children in particular. Emphasis will be placed on involving women farmers as technical innovators, resource managers and homemakers and developing their capacity, particularly in the area of postharvest handling and processing. E.g., introduction of Zero Energy Cool Chamber (including charcoal cooler) and simple solar drying technologies. In addition, beneficiaries will be taught techniques for improving market access of their harvested produce including farmers’ information circulation, storage facilities and packaging. This activity will be led by AVRDC with inputs from IITA.  ***On-farm integration of vegetables with poultry research theme:*** This is a new area being brought in to enhance income diversification and improve nutrition outcomes of the project. Treatments on the demonstration trials will include inclusion of poultry droppings as organic manure compared with no application of other organic and non-organic fertilizers and compared with treatments under inorganic fertilizers. In parallel, we will provide inputs and information on the use and evaluation of vegetable residues as poultry feed under the livestock and feed research theme and collaborate with them and the natural resource management research theme to evaluate the nutrient recycling pool effects on soil fertility and plant nutrition. This activity will not commence until the 2015-2016 production season and will be coordinated by AVRDC but with expected strong inputs from ILRI and IITA.  ***Community–based mobilization of farmers to access viable and/or functional markets and provision of market information systems:***Results from our baseline and community sensitization efforts indicate a need to encourage the establishment of vegetable farmer organizations, while strengthening existing ones as a vehicle for disseminating identified technologies to achieve larger scale impact. One aspect of this is the continued supply of produce to retail outlets, which can be improved through mobilizing farmer market groups to allow their coordinated produce to meet the demands of large volume regional markets, as well as institutional consumers such as schools, hospitals etc. Beneficiary farmers will also be encouraged to form organized groups to access high-value markets. This objective will contribute to improving household food and nutrition securityamong the most vulnerable households and their members, especially women and children. This will be done in collaboration with other existing project initiatives such as the Tanzanian Agricultural Productivity Program (TAPP) and other existing development initiatives in the project region and a likely upcoming sister USAID scaling up project (if funded). The activity will be led by AVRDC.  ***Anchoring farmer sensitization on vegetable nutritional awareness and promotion for widespread adoption of tested technologies:***Once tested technologies from the demonstration trials have been finally validated, we will undertake strategic community sensitization on the nutritional importance of vegetables and demonstrations for selected vegetables along with promotion of the improved best bet agronomic practices to target beneficiary farmers via the existing project R4D platform, schools and hospital gardens in the project district. This will include a combination of community field days, farmer exchange visits, mass rallies and facilitate seed fairs by private seed companies. This will be a major priority of activities in the 2015-2016 production seasons. The activity will be led by AVRDC. |
| ***3.5 DELIVERABLES***  ***The deliverables under this theme for the 2014-2015 production season are:***   1. At least three additional adapted elite varieties of selected traditional vegetables (i.e., amaranth, sweet pepper, Ethiopian mustard) identified for integration in maize-based farming systems in the target communities. 2. Baseline study on contribution of vegetable integration within maize based farming systems to dietary diversity published in a peer reviewed journal. 3. At least one MSc. Thesis on “Effect of newly introduced AVRDC vegetable technologies on reduction of poverty in the Babati district of Tanzania” completed and extracts drafted for submission to a peer-reviewed journal. Strategies for engaging women and other village members in community-based seed and seedling production piloted and validated for out scaling via community sensitization and on-farm farmer managed demonstrations fields. 4. Cost and return analysis of elite vegetable varieties, healthy seedlings and ICPM in comparison with standard farmer practices finalized and shared with farmers during field days and via the R4D platform. 5. At least 100 farmers engaged in elite AVRDC vegetable variety evaluation for adaptation in target communities of the study area. At least 400 farmers aware of elite vegetable varieties through community sensitization and on-farm farmer managed demonstration plot assessment. 6. Appropriate ICPM interventions using good agricultural practices of vegetable pest and diseases to realize the opportunity for vegetables to be integrated into existing maize-based farming systems identified and documented. 7. Diagnostic protocols for community healthy seedling systems development identified and farmer awareness sensitization protocols on pests and diseases developed. 8. Tested and validated postharvest handling practices that add value to produce and improve shelf-life adopted following their exposure and introduction to at least 100 farmers. 9. At least 100 farmers trained in postharvest handling practices and farm business and entrepreneurship skills that add value to produce while improving shelf-life to reduce seasonal gluts and shortages and enhance year-round availability of produce for sale and home consumption. 10. Targeted strategies for testing and validation for increased demand creation and promotion of selected elite vegetable varieties and scaling-up of production technologies for increased vegetable consumption within maize-based cropping systems identified for next season.   ***The deliverables under this theme for the 2015-2016 production season are:***   1. At least 300 additional farmers aware of and engaged in additional elite AVRDC vegetable variety evaluation for adaptation in target communities of the study area through community sensitization and dissemination of results of demonstration trials from earlier production seasons. 2. Appropriate ICPM of vegetable pests and diseases to realize the opportunity for vegetables to be integrated into existing farming systems disseminated to over 500 farmers. 3. At least two community seedling units established within two target project villages following initial mobilization, training and set-up. Two community seedling production units fully functional and producing healthy seedlings for project beneficiaries with other communities linked to other potential initiatives such as TAPP. 4. At least 150 additional farmers trained in postharvest handling, farm business and entrepreneurship skills that add value to produce while improving shelf-life to reduce seasonal gluts and shortages and enhance year-round availability of produce for sale and home consumption. 5. At least one market information and/linkages for farmers to access vegetable markets developed. 6. Targeted strategies for testing and validation for increased demand creation and promotion of selected elite vegetable varieties and scaling-up of production technologies within maize-based cropping systems identified for potential next phase of the project. 7. At least one best-bet technology for optimizing water harvesting and/or water use efficiency for vegetables identified for subsequent dissemination to beneficiary farmers in a possible next phase of the project. 8. At least one best-bet technology for enhanced optimal nutrient recycling of vegetable-poultry integration in the farming system (i.e., vegetable residue waste as a feed conservation method for poultry feed and poultry dropping as organic manure) of the project area identified and evaluated (*in collaboration with livestock and feed research theme*). 9. At least two M.Sc. students on the (i) vegetable poultry integration, (ii) ICPM analysis and policy recommendations completed. 10. Effectiveness of technological dissemination approaches for increased demand creation and promotion of selected elite vegetable varieties and scaling-up of production technologies for increased vegetable consumption within maize-based cropping systems evaluated. |

***3.6 ACTIVITY SCHEDULE FOR THE 2014-2015 PRODUCTION SEASON***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TIME FRAME** | **ACTIVITIES** | **LOCATION** | **RESOURCES** | **RESPONSIBLE** |
| Nov 2014 | -Follow up with documentation of ongoing activities  -Rapid rural appraisal aiming at sensitizing men and women as a strategy to get more women involved in vegetable production activities  -Follow up and collection of soil test results before preparation of demo plots*(categorised best practices and normal practices)* in the regions  -Site selection for improved vegetable seeds field trials | -Babati  -Replicate to other surveyed region | -Car and fuel  -Technical staff (incl. Specialist in gender and agriculture)  -Financial resources | -AVRDC scientist  -IITA Scientist  -Subject matter specialists at district, ward and village level |
| Dec 2014 | -Purchasing/collection of inputs for demonstration best practices and field experimental trials (seeds, fertilizers, pesticides etc.)  -Preparation of farmer friendly training materials *(pamphlets, brochures, posters showing good practices, vegetable diseases/pests symptoms and control measures)* | -Arusha/Babati  -Replicate to other selected/surveyed communities | -Vegetable seeds  -Technical staff  -Financial resources | -AVRDC scientist  -IITA |
| Jan- April 2015 | -Facilitation and establishment of demonstration plots categorised best practices and normal practices  -Sensitization meeting in progression  -Joint field visit (feedback and improvement)  -Field days (about good practices within the district)  -Stakeholders meeting (identification of joint activities and networking)  -Training of extension agents and farmer trainers (groupwise at least 3days per group)  -Ongoing practical training in demonstration plots stage by stage crop-wise (once per month)  -Organize and facilitate stakeholders meeting  (one per district)  -Establish seedling production unit | -Surveyed villages in Babati | -Stationeries  -Car and fuel  -Technical staff  -Financial resources | -AVRDC scientist  -IITA Scientist  -Subject matter specialists at district, ward and village level  -Identified stakeholders working in vegetable sector |
| March – May 2015 | -Set-up on-farm trials of elite vegetable varieties for agronomic adaptability and consumer taste and preferences  -Sensitization meeting in progression | Surveyed villages in Babati, Kiteto and Kongwa | Stationeries  -Car and fuel  -Financial resources | -AVRDC & IITA Scientists  -Subject matter specialists at district, ward and village level |
| Jan- June 2015 | -Follow up/monitoring of ongoing established activities and extension support of the established demonstration plots  -Postharvest good practices *(drying, cooling, vegetable handling, vegetable preparation and processing)*  -Ongoing practical training in demonstration plots stage by stage crop-wise  -Food safety awareness campaign and soil and water sampling analysis | -Surveyed villages in Babati, Kiteto and Kongwa | -Car and fuel  -Technical staff  -Financial resources | -AVRDC scientist  -Subject matter specialists at district, ward and village level  IITA & AVRDC Scientists  -Subject matter specialists at district, ward and village level |
| July-Aug 2015 | -Execute farmer and extension agents study tour to AVRDC and Lushoto  -Ongoing practical training in demonstration plots stage by stage cropwise and on-farm evaluation (undertake cost-benefit analysis) of elite vegetable varieties for agronomic adaptability and consumer taste and preferences  -Identification of diagnostic protocols for pests and diseases as common constraints | -Babati  -Replicate to other surveyed region when resources allows | -Car and fuel  -Technical staff  -Financial resources | -AVRDC scientist  -Subject matter specialists at district, ward and village level  -Selected farmers(TOTs) |
| Sept-Oct 2015 | -Follow up and extension support of on-going farm field activities  -Field *visits (collection vegetable farm data recorded from nursery to and after harvesting)*  -Ongoing practical training in demonstration plots stage by stage cropwise  -organize and facilitate project feedback meeting  -organize and facilitate joint planning meeting for 2015 | -Surveyed villages in Babati, Kiteto and Kongwa | -Car and fuel  -Technical staff  -Financial resources | -AVRDC scientist  -IITA Scientist  -Subject matter specialists at district, ward and village level |

***3.7 TWO YEAR LOGFRAME FOR 2014-2016***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **ESA Master logframe component** | **Vegetable integration logframe** | | | |
| **ESA Logframe Output**  **(Reference)** | **Theme Outputs:** | **Objectively verifiable indicators** | **Means/Source of Verification** | **Important assumptions** |
| **Research Output 1,** Output 1: Intervention sites identified at an appropriate level, and characterized. **See *Activity 1.1*** | Output 1: Intervention sites for vegetable integration within maize based farming systems identified at new impact sites (scaling out):   * Maintain current demonstration sites * Select sites within target communities * Select sites outside of the communities | 1.1 ensure continued involvement of demonstrations at current 4 target community sites  1.2 additional 6 communities suitable for vegetable farming within the AR sites in Babati district identified by October 2014  1.3 communities suitable for vegetable farming within the AR sites in Malawi and Zambia identified by October 2014 | Site selection based on 2014 data and follow up visits using market access, access to irrigation and participatory community rapid assessment approaches conducted | Availability of minimum required biophysical and socio-economic data coupled with expert opinions from DAICOs and various community leaders |
| **Research Output 2,** Output 5: Innovations that increase resilience and productivity of farming systems deployed. ***See Activity 5.1*** | Output 2: Farmer participatory selection of new, improved elite varieties in demonstration site communities   * Plant additional crop species and elite varieties for continued selection (current demo sites) | 2.1 3 new crops and varieties planted at the 4 demonstration AR sites in Babati district by November 2014 | Community sensitization and farmer participatory selection field reports | Farmers willing ness to select additional varieties. |
| **Research Output 2,** Output 5: Innovations that increase resilience and productivity of farming systems deployed. ***See Activities 5.2 and 5.3*** | Output 3: Best-bet management packages around the most promising farmer selected elite vegetable varieties suited to diverse agro-climatic zones in the project district maintained and scaled out   * Conduct demonstration plots with improved vegetable management practices (seedling health, irrigation, agronomy, ICPM, …) | 3.1 Community level best bet promotional strategies established at 4 original | 3.1 Community sensitization and field demonstration reports  3.2 Cost-benefit analysis enterprise budgets (spreadsheets) and report on assessment of introduced technologies compared against farmer practice plots  3.3. Field experimental reports on optimal cropping combination of maize-vegetable integration as intercrop and in rotation or relay cropping | Farmers and community leaders will be willing to provide land for setting up demonstration plots and manage trials as per pre-agreed arrangements |
|  |  |  | 1.2 |  |
| **Research Output 2,** Output 7: Innovations that increase availability and consumption of safe and nutritious food products deployed. ***Activities 7.3 and 7.4*** | Output 4: Capacity of farmers to improve vegetable production (GAP) and post-harvest practices built   * Regular training during different stages of growth * Community exchange visits for demo exposure | 4.1 farmers trained in vegetable production (GAP) and post-harvest handling practices during training sessions. | Farmer training reports | Farmers cooperation in training programs |
| **Research Output 2,** Output 3: Potential impact of various SI technologies in different development stages assessed. **See Activity 3.2** (TESTING CONMPONENT)  & **Research Output 2,** Output 8: Innovations that address emerging agricultural production challenges deployed. ***See Activity 8.1* (VALIDATION COMPONENT)**  ***&* Research Output 3 (SCALING OUT COMPONENT)** | Output 5: Community-based seedling production units installed in each target community   * Build poly/screen-house for seedling production under controlled conditions * Train cooperating farmers in healthy seedling production * Train farmers in healthy seed production techniques | 5.1 4 Community-based seedling production units built and equipped.  5.2 farmers trained in healthy seedling production by September 2015.  .5.3. Scaling out of community seedling units by September 2016. | Units up and running and producing healthy seedlings | Demand for seedlings provides a continuous need to supply;  Price of seedlings is affordable and acceptable to farmers |
| **Research Output 1,** Output 3: Potential impact of various SI technologies in different development stages assessed. See Activity 3.2 | Output 6: Cost-benefit analysis of technological packages evaluated   * Assess the costs and returns of each promoted technology * Compare results of new technologies with farmer standard practices | 6.1 gross margin computation of promoted technologies  6.2 comparison of costs and farmer acceptance of promoted technologies | Cost and returns analysis spreadsheets | Ability of farmers to accurately recall data |

***3.8 BUDGET (USD) FOR 2014-2015 PRODUCTION SEASON\****

|  |  |  |  |
| --- | --- | --- | --- |
| **Line item** | **Category** | **Amount ($US)** | |
|  |  | **AVRDC** | **IITA** |
| Personnel | IRS | 8,000 | 8,000 |
| NRS | 6,000 | 3,600 |
| Travel |  | 6,000 | 3,400 |
|  | Field demonstration (seed and seedling treatment) trials, field demonstration data collection and related validation surveys | 8,500 | 3,000 |
| Community sensitization, awareness and demand creation meetings and training in seed nursery management, agronomy, postharvest and market information systems | 5,000 | 3000 |
| Supplies & Services | Seed distribution, Office supplies, phone and internet communication, publicity, factsheets and reports | 3,000 | 2,300 |
| Meetings with partners and contracted services on vegetable poultry integration | 3,000 | 2,500 |
| Sub-total |  | 39,500 | 25,460 |
| Overheads (18.5%) |  | 7,308 | 0 |
| **Sub-Total ($)** |  | **46,808** | **25,800** |
| **Total ($)** |  | **72,608** | |

*\* Deliverables for 2016 are based on same estimated quantum of budget allocation for the 2015-2016 production seasons.*

***3.9 FtF INDICATOR TARGETS***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Indicator / Disaggregation | Baseline | 2013 | | | | 2014 | | 2014 | | 2015 | | 2016 | |
| Target | | Actual | | Target | | Actual | | Target | | Target | |
| 4.5.2(2): Number of hectares under improved technologies or management practices as a result of USG assistance (RIA) (WOG) |  | 0.8 | | 0.5 | | 2 | | 4 | | 7 | |  | |
| Technology type |  |  | |  | |  | |  | |  | |  | |
| crop genetics |  | 0.8 | | 0.5 | | 2 | | 4 | | 7 | |  | |
| pest management |  | 0.8 | | 0.5 | | 2 | | 4 | | 7 | |  | |
| disease management |  | 0.8 | | 0.5 | | 2 | | 4 | | 7 | |  | |
| soil-related |  |  | |  | |  | |  | |  | |  | |
| irrigation |  |  | |  | |  | |  | |  | |  | |
| water management |  |  | |  | |  | |  | |  | |  | |
| climate mitigation or adaptation |  |  | |  | |  | |  | |  | |  | |
| other |  |  | |  | |  | |  | |  | |  | |
| total w/one or more improved technology |  |  | |  | |  | |  | |  | |  | |
| Disaggregates Not Available |  |  | |  | |  | |  | |  | |  | |
| New/Continuing |  |  | |  | |  | |  | |  | |  | |
| New |  |  | |  | |  | |  | |  | |  | |
| Continuing |  |  | |  | |  | |  | |  | |  | |
| Disaggregates Not Available |  |  | |  | |  | |  | |  | |  | |
| Sex |  |  | |  | |  | |  | |  | |  | |
| Male |  |  | |  | |  | |  | |  | |  | |
| Female |  |  | |  | |  | |  | |  | |  | |
| Joint |  |  | |  | |  | |  | |  | |  | |
| Association-applied |  |  | |  | |  | |  | |  | |  | |
| Disaggregates Not Available |  |  | |  | |  | |  | |  | |  | |
| 4.5.2(5): Number of farmers and others who have applied new technologies or management practices as a result of USG assistance (RIA) (WOG) |  | 80 | | 71 | | 120 | | 140 | | 240 | |  | |
| New/Continuing |  | 80 | | 71 | | 120 | | 198 | | 240 | |  | |
| New |  | 80 | | 71 | | 60 | | 129 | | 100 | |  | |
| Continuing |  | 0 | | 0 | | 60 | | 69 | | 140 | |  | |
| Disaggregates Not Available |  |  | |  | |  | |  | |  | |  | |
| Sex |  |  | |  | |  | |  | |  | |  | |
| Male |  | 60 | | 55 | | 75 | | 116 | | 196 | |  | |
| Female |  | 20 | | 16 | | 45 | | 24 | | 44 | |  | |
| Disaggregates Not Available |  |  | |  | |  | |  | |  | |  | |
| 4.5.2(7): Number of individuals who have received USG supported short-term agricultural sector productivity or food security training (RIA) (WOG) |  |  | |  | |  | |  | |  | |  | |
| Type of individual |  |  | |  | |  | |  | |  | |  | |
| Producers |  | 80 | | 71 | | 120 | | 198 | | 240 | |  | |
| People in government |  | 0 | | 0 | | 0 | | 0 | | 0 | |  | |
| People in private sector firms |  | 0 | | 0 | | 0 | | 0 | | 0 | |  | |
| People in civil society |  | 0 | | 0 | | 0 | | 0 | | 0 | |  | |
| Disaggregates Not Available |  |  | |  | |  | |  | |  | |  | |
| Sex |  |  | |  | |  | |  | |  | |  | |
| Male |  | 60 | | 55 | | 75 | | 106 | | 196 | |  | |
| Female |  | 20 | | 16 | | 45 | | 92 | | 44 | |  | |
| Disaggregates Not Available |  |  | |  | |  | |  | |  | |  | |
| 4.5.2(11): Number of food security private enterprises (for profit), producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) receiving USG assistance (RIA) (WOG) |  | 0 | | 0 | | 3 | | 5 | | 5 | |  | |
| Type of organization |  |  | |  | |  | |  | |  | |  | |
| Private enterprises (for profit) |  | 0 | | 0 | | 0 | | 0 | | 0 | |  | |
| Producers organizations |  | 0 | | 0 | | 0 | | 0 | | 0 | |  | |
| Water users associations |  | 0 | | 0 | | 1 | | 2 | | 2 | |  | |
| Women's groups |  | 0 | | 0 | | 1 | | 2 | | 3 | |  | |
| Trade and business associations |  | 0 | | 0 | | 0 | | 0 | | 0 | |  | |
| Community-based organizations (CBOs) |  | 0 | | 0 | | 1 | | 1 | | 1 | |  | |
| Disaggregates Not Available |  |  | |  | |  | |  | |  | |  | |
| New/Continuing |  | 0 | | 0 | | 3 | | 3 | | 3 | |  | |
| New |  | 0 | | 0 | | 3 | | 2 | | 2 | |  | |
| Continuing |  | 0 | | 0 | | 0 | | 0 | | 0 | |  | |
| Disaggregates Not Available |  |  | |  | |  | |  | |  | |  | |
| 4.5.2(12): Number of public-private partnerships formed as a result of FTF assistance (S) |  | 0 | | 0 | | 0 | | 0 | | 0 | |  | |
| Agricultural production |  |  | |  | |  | |  | |  | |  | |
| Agricultural post harvest transformation |  |  | |  | |  | |  | |  | |  | |
| Nutrition |  |  | |  | |  | |  | |  | |  | |
| Multi-focus |  |  | |  | |  | |  | |  | |  | |
| Other |  |  | |  | |  | |  | |  | |  | |
| Disaggregates Not Available |  |  | |  | |  | |  | |  | |  | |
| 4.5.2(27): Number of members of producer organizations and community based organizations receiving USG assistance (S) |  |  | |  | | 3 | | 4 | | 5 | |  | |
| Type of organization |  | 0 | | 0 | | 0 | | 0 | | 0 | |  | |
| Producer organization |  | 0 | | 0 | | 3 | | 4 | | 5 | |  | |
| Non-producer-organization CBO |  | 0 | | 0 | | 0 | | 0 | | 0 | |  | |
| Disaggregates Not Available |  |  | |  | |  | |  | |  | |  | |
| Sex |  |  | |  | |  | |  | |  | |  | |
| Male |  |  | |  | |  | |  | |  | |  | |
| Female |  |  | |  | |  | |  | |  | |  | |
| Disaggregates Not Available |  |  | |  | |  | |  | |  | |  | |
| Size of MSME |  |  | |  | |  | |  | |  | |  | |
| Micro |  |  | |  | |  | |  | |  | |  | |
| Small |  |  | |  | |  | |  | |  | |  | |
| Medium |  |  | |  | |  | |  | |  | |  | |
| Disaggregates Not Available |  |  | |  | |  | |  | |  | |  | |
| MSME Type |  |  | |  | |  | |  | |  | |  | |
| Agricultural producer |  |  | |  | |  | |  | |  | |  | |
| Input supplier |  |  | |  | |  | |  | |  | |  | |
| Trader |  |  | |  | |  | |  | |  | |  | |
| Output processors |  |  | |  | |  | |  | |  | |  | |
| Non agriculture |  |  | |  | |  | |  | |  | |  | |
| Other |  |  | |  | |  | |  | |  | |  | |
| Disaggregates Not Available |  |  | |  | |  | |  | |  | |  | |
| Sex of owner |  |  | |  | |  | |  | |  | |  | |
| Male |  |  | |  | |  | |  | |  | |  | |
| Female |  |  | |  | |  | |  | |  | |  | |
| Joint |  |  | |  | |  | |  | |  | |  | |
| n/a |  |  | |  | |  | |  | |  | |  | |
| Disaggregates Not Available |  |  | |  | |  | |  | |  | |  | |
| 4.5.2(39): Number of new technologies or management practices in one of the following phases of development: (Phase I/II/III) (S) | The phases are not aggregated | | | | | | | | | | | | |
| Phase 1  Number of new technologies or management practices under research as a result of USG assistance |  | |  | |  | |  | |  | |  | |  |
| Phase 2  Number of new technologies or management practices under field testing as a result of USG assistance |  | | 3 | | 4 | | 4 | | 3 | | 4 | |  |
| Phase 3  Number of new technologies or management practices made available for transfer as a result of USG assistance |  | |  | |  | |  | |  | |  | |  |
| Disaggregates Not Available |  | |  | |  | |  | |  | |  | |  |
| Transboundary vs. national basins |  | |  | |  | |  | |  | |  | |  |
| Transboundary basins |  | |  | |  | |  | |  | |  | |  |
| National basins |  | |  | |  | |  | |  | |  | |  |
| Disaggregates Not Available |  | |  | |  | |  | |  | |  | |  |
| Scale |  | |  | |  | |  | |  | |  | |  |
| Basin-level |  | |  | |  | |  | |  | |  | |  |
| Sub-basin level |  | |  | |  | |  | |  | |  | |  |
| Field level |  | |  | |  | |  | |  | |  | |  |
| Disaggregates Not Available |  | |  | |  | |  | |  | |  | |  |
| 4.5.2(42): (4.5.2-28) Number of private enterprises (for profit), producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) that applied new technologies or management practicies as a result of USG assistance (RIA) (WOG) |  | | 0 | | 0 | | 0 | | 0 | | 0 | |  |
| Type of organization |  | |  | |  | |  | |  | |  | |  |
| Private enterprises (for profit) |  | |  | |  | |  | |  | |  | |  |
| Producers organizations |  | |  | |  | |  | |  | |  | |  |
| Water users associations |  | |  | |  | |  | |  | |  | |  |
| Women's groups |  | |  | |  | |  | |  | |  | |  |
| Trade and business associations |  | |  | |  | |  | |  | |  | |  |
| Community-based organizations (CBOs) |  | |  | |  | |  | |  | |  | |  |
| Disaggregates Not Available |  | |  | |  | |  | |  | |  | |  |
| New/Continuing |  | |  | |  | |  | |  | |  | |  |
| New |  | |  | |  | |  | |  | |  | |  |
| Continuing |  | |  | |  | |  | |  | |  | |  |
| Disaggregates Not Available |  | |  | |  | |  | |  | |  | |  |
| Firm |  | |  | |  | |  | |  | |  | |  |
| CSO |  | |  | |  | |  | |  | |  | |  |
| Disaggregates Not Available |  | |  | |  | |  | |  | |  | |  |
| Disaggregates Not Available |  | |  | |  | |  | |  | |  | |  |

## Theme 4. Food storage, value addition and mycotoxin management

***4.1 RESEARCH TEAM (Theme leader: Adebayo Abass, IITA, George Mahuku, IITA)***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Name** | **Gender** | **Institution** | **Discipline** | **Qualification** | **Project role/responsibility** | **% time** |
| Abass Adebayo | M | IITA | Food Technologist | PhD | Principal Investigator | 5 |
| George Mahuku | M | IITA | Plant Pathologist | PhD | Mycotoxin Coordinator | 5 |
| Leonard Leo | M | IITA | Statistician | BSc | Data management | 10 |
| Gabriel Tito Ndunguru | M | IITA | Food Scientist | PhD | Project consultant | 25 |
| Lunna Hemed-Kyungu | M | (COUNSENUTH) | Nutritionist | PhD | Project consultant in Food product development | 5 |
| Julius Ntwenya | M | University of Dodoma | Nutritionist | PhD | Food security | 5 |
| Grace Michael | F |  | Food Technologist | B.Sc. | Project consultant | 5 |
| Hossana Ngonyani | F |  | Product Devpt. Officer |  | Project consultant | 5 |
| Simon Boniface | M | IITA | Mycotoxin specialist/Vector Entomologist | PhD | Handling day to day work on mycotoxins | 50 |
| Emmanuel Koyano | M | IITA | Research supervisor | MSc | Collection, preparation and analysis of mycotoxin samples | 5 |
| Mark Lwakatare | M | IITA | Food Safety | MSc. | Project Consultant | 50 |
| Edgar Lyakurwa | M | SUA- iAGRI | Social scientist | BSc | Refinement and deployment of awareness strategy | 5 |
| Jocelyn Kaganda | F | TFNC | Nutrition food safety | PhD | Development of awareness raising materials | 10 |

***4.2 SUMMARY***

Postharvest losses and mycotoxins contamination are caused by poor handling and storage practices, accentuated by limited market access and narrow options for processing of foods into more safe and shelf stable products. During the last two years of investigating post-harvest problems in Babati, results showed that for maize, significant losses occur during field and home storage, when insects and pests can damage an average to 40% of stored maize. The field maize losses ranged from 20% caused by rats, pests and improper harvesting while during shelling losses of maize was 5%. But the traditional processing practices were very tiresome to women and also time-consuming. During storage of maize, losses by larger grain borer (*Prostephanus truncatus*) could be as high as 90% and 15 – 25% by grain weevil (*Sitophilus granarium*). There were also losses caused by confused flour beetle (*Tribolium confusum)* and lesser grain borer (*Rhyzopertha dominica)*.

The jumpstart inception project in 2012, we quantified mycotoxin levels of maize in Babati District. Results for Babati District showed that total aflatoxin prevalence ranged between 70% and 87% with contamination levels ranging from 5µg/kg to 418µg/kg, making it being among the districts with alarming contamination of the toxin in the country. Results from the analysis of maize samples collected from field (at harvest) and stores (post-harvest) in 2013/2014 showed that aflatoxin and fumonisin ranged from 0 to 26.2µg/kg and 0 to 46.2mg/kg, respectively. Moreover the two toxins are prevalent in Babati although with varying levels. Work during the previous years have created some degree of awareness about mycotoxins in Babati, but and ‘fit-for-purpose’ communication strategies and tools are required to target different sections of commodity value chain.

This theme will integrate the previous ‘work packages’ on mycotoxins and post-harvest processing and build on research conducted during the last two years. A link will be created with Theme 2 (Integrated Livestock Feed component) to determine the extent of mycotoxin contamination in feed of free range poultry.

We willcontinue to identify and test adaptable postharvest management techniques that reduce post-harvest losses, improve food safety, and increase the income and nutritional status of the communities. This will be achieved by increasing the access of smallholder farmers to improved storage technologies (such as oxygen-moisture impermeable bags) combined with appropriate improved mechanical processing technologies (e.g. shelling and drying) by working with lead farmers to test a combination of these technologies to fully address postharvest loss and nutrition inadequacy among farming households. The project will evaluate labor and time savings from the use of mechanical processing equipment for simple farm operations such as shelling and drying. Pilot centers will be established to provide mentorship directly to farmers on the various technologies available and train the farmers to improve their market linkage expertise; increase both safety and nutrient density of household foods.

Similarly mycotoxin levels will be monitored by taking samples of cereal grains stored by smallholder farmers using improved storage technologies combined with improved mechanical processing technologies. Sample analysis will be carried out at IITA. There will also be integration with Theme 2 by determining the safety of feed rations of indigenous of poultry tested under Activity 4 of Theme 2. The toxin analysis will be performed by IITA using the methods developed and tested in 2013/2014. TNFC will adapt their experiences on successful campaign for dissemination of knowledge on nutritional security for mycotoxin management messages tailor-made for participants of cereal value chain.

This project will continue to identify and deploy control interventions to mitigate mycotoxin contamination in 6 target villages of Babati and hence safeguard the health of people, livestock and realize income generating opportunities through trade (including access to regulated markets where mycotoxin contamination is prohibited).

***4.3 RESEARCH PROBLEM AND JUSTIFICATION***

Postharvest food loss is a challenge that contributes to food insecurity and reduces the income of millions of smallholder farmers. Maize is a major staple as well as a commercial crop in Babati. Yield per unit area has the potential to double with the use of improved inputs. While the use of pest control chemicals to control losses is common among the farmers, the effectiveness is not guaranteed and possibility of extensive public poisoning or public health hazard is high because of the existence of fake products and tendency of farmers to apply the chemicals at excessively high levels while the lack the knowledge of establishing the residual compound in the grains when marketing them.

Previous problem diagnosis and study of the extent of postharvest losses in Babati and other districts in northern and central Tanzania suggest that traditional harvesting, shelling and storage practices contribute to between 20-50%, 5%, and 15-25% losses of grains respectively. Inappropriate shelling, drying and storage practices lead to high grain damage, contamination by mould, discoloration (with a consequence of reduced market price) and high aflatoxin levels. Field experience suggests that smallholder farmers have very narrow range of diets although there is a very wide range of cultivated crops. There is an acute knowledge of balanced diet, with monotonous consumption of maize-based meals. To ameliorate these situations, erstwhile ‘work package’ on postharvest management was involved in testing of various processing and storage technologies in Babati. Some lead farmers were involved in the use of various technologies related to maize shelling, drying and storage with much success. Results from the participatory technology testing suggest that while storage of maize in oxygen impermeable bags preserves grains with zero loss after 8-month storage. On the other hand, grain damage in traditional cribs and polypropylene bags was up to 40% during the same storage period. There are indications that a large number of farmers have requested for access to the tested technologies.This theme has progressively developed a model of using postharvest technologies to boost farming systems intensification through a step-wise approach that include problem diagnosis and testing of possible solutions (technology testing; Figure 1). However, the impact of improved postharvest management approach on farmers’ decision and migration towards farming system intensification needs to be investigated with appropriate socio-economic research methodologies.

Mycotoxins contamination levels of maize in Babati district is still a significant problem of public health. Aflatoxin and fumonisin in maize collected in 2013/14 (about 1500 samples) from three of the six target villages showed contamination levels of 0 to 26.2µg/kg in Sabilo, 0 to 4µg/kg in Seloto and 0 to 3.6mg/kg in Long for total aflatoxin and 0 to 42mg/kg in Seloto and 0 to 14mg/kg in both Sabilo and Long for total fumonisin.

Mycotoxin levels will be monitored by taking samples in cereal grains stored by smallholder farmers using improved storage technologies combined with improved mechanical processing technologies as compared to the local/traditional practices. In addition, poultry feed samples will continue to be collected (in collaboration with research theme “Improving productivity of indigenous chicken through better nutrition and management in mixed crop-livestock farming systems in Babati, Tanzania”) and analyzed for mycotoxin. Sample analysis will be carried out at IITA Dar es Salaam using the methods developed and tested in 2013/2014.

In the erstwhile ‘work package’ on mycotoxins, some emphasis was placed on creating awareness among farmers and policy-makers. However, enhancing awareness for behavioral change management requires consistent and repeated efforts. In Theme 4, we will build on previous experiences on awareness creation about mycotoxins and develop strategies and pilot-testing communication tools for enhancing knowledge about mycotoxin management in the maize value chain. The Tanzania Aflatoxin Steering Committee has placed emphasis on enhancing awareness among crop value chain participants. This is also in line with the priorities of the Partnership for Aflatoxin Control in Africa (PACA)

Diagnosis of postharvest handling constraints and the causes of postharvest loss of food in Babati; **2012/2013**

Participatory field testing of improved processing technologies and postharvest loss prevention technologies; **2013/2014**

Pilot-testing of processing/storage technologies at commercial level, farmers’ training & technology dissemination; **2014/2015**

**Future or new locations:**

Dissemination and economic viability assessment of postharvest management technologies

**Africa RISING Postharvest/processing research activities**

**Time**

Figure 2: Step-wise application of improved postharvest management technologies to boost farming systems intensification

***4.4 OBJECTIVES/RESEARCH QUESTIONS***

The main focus of the work is to promote and disseminate appropriate post-harvest management technologies (Output 6.4 for 2014/2015) and as a long term goal is to apply improved postharvest technologies to boost sustainable intensification of maize farming system and improve food safety and security in the project areas. Improved processing and storage will be tested at commercial scale (piloting) for reducing losses and assisting farmers to store and market when the price is most favorable.

**Research questions**

1. Which combination of technology packages can reduce the vulnerability of households to food insecurity, food toxins (e.g. aflatoxins), low income and poor nutrition?
2. To what extent can labor and time inputs into postharvest activities be reduced through the use of machines, especially by women?
3. To what extent can the various crop processing (handling) and storage technologies mitigate mycotoxin contamination in food and feed?
4. Are there potential risks of mycotoxins in experimental rations being developed for enhancing productivity of free range poultry?
5. What communication strategies and tools are required to enhance knowledge about mycotoxins and their management among various segments of crop value chain?

***4.5 METHODS***

The on-going establishment of one pilot processing center in each of the project villages will be completed and used in promoting the postharvest technologies. The centres will also be used for the training of women in the project communities on improved nutrition. A package of technologies, extensive training and dissemination efforts will be applied to save the population from a potential future reliance on purchased foods and to prepare the population for food sufficiency and ability to make own high quality and safe foods. A range of previously tested packaging techniques and crop processing technologies will be evaluated using the centrally-located (community-based) pilot processing areas.

The technologies will be used to promote better harvesting, handling and storage practices to reduce post-harvest losses, mycotoxin contamination and promote processing and value addition, reduce losses and increase diversified food products. We will use dedicated or lead farmers, improved storage techniques, the use of high capacity motorized shelling machines, collapsible dryer cases for drying of maize to 13% before storage, high capacity storage bags for maize storage without using chemicals and new approaches for increasing household food nutrient density. Local entrepreneurs and traders will be assisted and linked with the sources of the processing, packaging and storage facilities.

Cereal grains handled/stored by the farmers using improved postharvest technologies and the local/traditional storage structures will be analysed for mycotoxin at IITA using the Neogen system standardized for analysis of maize grains during previous years. Information collected in the sample questionnaire will be interrogated and correlated with analysed mycotoxin levels to ascertain which production, processing and storage practices are most directly linked with mycotoxin contamination.

For the integrated activity with Theme 2, poultry feed ingredients and formulations will be collected IITA and analyzed by IITA. Samples will also be collected from the feeding pans of the chicken from the households in order to assess the status of aflatoxin and fumonisin contamination in course of feeding chicken. Forty-four samples of the intended ingredients have been collected earlier. Samples from the feed formulations and from the feeding pans will be collected later when Theme 2 starts to implement its activities on the ground. Due to the complex nature of the matrix of feed ingredients, mycotoxin analysis will be conducted by mycotoxin analysis protocols standardized last year.

The manner in which awareness constraints and opportunities for managing the constraints are tackled depends on the nature of the value chain segment. Based on “Previous Experiences of Aflatoxin Management Communication”, TNFC will determine the strategies for effective communication along the entire crop value chain. The messages will be pre-tested and most effective ones disseminated.

***4.6 LOGICAL FRAMEWORK:Innovations that increase availability and consumption of safe and nutritious food products deployed (Output 7 in ESA logframe)***

|  |  |  |  |
| --- | --- | --- | --- |
| **Objective statement** | **Verifiable Indicators** | **Sources of Verification** | **Assumptions** |
| **Super Goal** |  |  |  |
| Increased economic growth and improved livelihoods in Babati district | Change in GDP from agricultural sector.  Change in people living on more than 1$ per day | Government statistical report  World Bank annual reports |  |
| **Goal** |  |  |  |
| Enhanced livelihoods of small holder farmers of Babati through integrated farming system. | Percent change in income of farmers growing staple food crops, vegetable and keeping livestock.  Improved food security and consumer safety of Babati communities | Annual trade statistics data  World Health Organization Reports | Committed funds will be available and on time |
| **Purpose** |  |  |  |
| Enhanced adoption and application of postharvest technologies and innovations to increase the availability and consumption of safe and nutritious food products | 1. % of farmers aware of new/improved postharvest technologies by September 2016 2. % of maize growers using maize shelling machines and hermetic storage techniques to store produce and reduce pest infestation and losses in Tanzania by September 2016 3. % of maize farmers applying other improved postharvest technologies in Tanzania by September 2016 4. Number of direct beneficiaries reached through project support by September 2016 5. Levels of mycotoxin contamination | Baseline –and end-line M&E reports, subsequent impact analysis report by social economists, food scientists and mycologist; scientific publicaitons technical and non-technical reports, partner reports, project database | * Farmers are willing to take part in postharvest storage experiments; * Farmers are willing to provide their storage facilities for experiments; * Cost of application of postharvest technologies affordable to farmers and traders/technology suppliers * Financial services available for stakeholders to purchase new machines; * Mycotoxin contamination in food and feed properly monitored |
| **Project Outputs** |  |  |  |
| Output 1: Appropriate post-harvest handling technologies and processing techniques demonstrated and promoted | 1.1 At least three village level postharvest processing pilot centers for processing, storage and preservation of grains, legumes and horticulture products established by September 2014 | Physical pilot center infrastructure, project reports, databases and publications  Lab records on samples analyzed for mycotoxins | Lack of maintenance of the postharvest storage tools and pilot facilities in spite of trainings provided |
| 1.2 At least two improved postharvest technologies tested and demonstrated with men, women and youth farmers by September 2014 | Reports, databases, village centers, publications | Technologies will be available and affordable by the farmers.  Farmers will be ready to form groups and register as Innovation platforms  Farmers will be ready to allow scientists to access their storage systems. |
| 1.3 At least 30% increase in economic and social profitability of improved postharvest technologies achieved by maize farmers by September 2015 | Farmers’ business records  Reports, databases, publications | Social scientist will play their role as planned. |
| 1.4 Increased safety of household foods through reduced mycotoxin levels | Lab reports on mycotoxin contamination levels in foods | Grain handling and processing treatments are conducted well by communities |
| Output 2: Safe constituents Poultry feed ration identified | 2.1 Aflatoxins and fumonisin levels in various poultry feed constituents | Lab reports on number of samples tested |  |
| Output 3: Awareness created and information on postharvest technologies generated and disseminated, networking among stakeholders created | 3.1 At least 150 farmers/households trainedby September 2014 in novel processing, products development (high nutrient diet formulation) and preservation of locally produced grains, legumes, horticulture crops | Project training records; District authority records | Funds will be available on time |
| 3.2 Information prepared for dissemination through various channels by September 2014 | Documents/packages on postharvest technologies and mycotoxins filed  Radio and TV programs  Reports filed by media organizations | Enough information will be generated during the project implementation |
| 3.3 Research and Development Platforms for Babati districts involved in the use of improved postharvest technologies and prevention of mycotoxins supported | Number of R&D Platforms available in the villages  Policy documents containing postharvest and mycotoxins issues | Funds will be available  Local government of Babati will participate in the project |

***4.7 PROJECTED FTF INDICATORS FOR BOTH 2014/15 AND 2015/16***

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TITLE in FTF Results Framework (RF)** | **Indicator Title** | **Level of Collection** | **Indicator Type** | **Disaggregation** | **2014/2015 Target** | **2015/2016 Targets** |
| Enhanced human and institutional capacity development for increased agricultural sector productivity | Number of farmers and others who have applied new technologies or management practices as a result of USG assistance | Village;  Farmers - | Output | Village;  Gender | 3 villages,  Male -1,000 & Female -1,200 | 6 villages;  Male -1,500 & female2,000 |
| Enhanced human and institutional capacity development for increased agricultural sector productivity | Number of individuals who have received USG supported short-term agricultural sector productivity or food security training | Farmers & Processors | Output | Gender: | Male - 80  Female - 120 | Male -80, Female 120 |
| Enhanced human and institutional capacity development for increased agricultural sector productivity | Number of food security private enterprises (for profit), producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) receiving USG assistance | Village | Output | Type of entrepreneurs and agents of dissemination of postharvest technologies to farmers | Local entrepreneurs -28; Associations- 6 | Local entrepreneurs -32;  Associations- 9 |
| Enhanced Technology Development, Dissemination, Management and Innovation | Number of new technologies or management practices in one of the following phases of development: …in Phase I: under research as a result of USG assistance …in Phase II: under field testing as a result of USG assistance …in Phase III: made available for transfer as a result of USG assistance | Project | Output | Type of technology | Crop storage – 2  Crop processing - 2 | Crop storage – 2  Crop processing - 2 |

***4.8 DELIVERABLES***

* One MSc student registered at the University of Dodoma or UDSM to focus on postharvest management techniques, mycotoxin or nutrition enhancement (IITA).
* At least an additional storage technique tested (e.g. Zerofly, PICS and/or silo) (IITA)
* At least 3 pilot processing and storage centers established (IITA)
* At least 60 farmers in each village trained on postharvest management (IITA)
* At least 3 local entrepreneurs linked to the source of processing machines and packaging materials (IITA)
* Fate (type, incidence, and quantity) of mycotoxins, with focus on aflatoxin and fumonisin, determined in grains processed, handled and stored under various practices (IITA)
* Mycotoxin risk profile in various crop constituents of poultry rations considered for decision making of optimal feed needed for enhancing poultry productivity (IITA).
* Communication tools for various segments of crop value chains tested (TFNC)

***4.9 LINKAGES WITHIN AFRICA RISING AND WITH OTHER SIMILAR INITIATIVES IN TANZANIA***

1. We will link with the Vegetable work package to support the work on storage and nutrient preservation options for vegetable.
2. We intend to link with SARD\_SC project in Kigoma to out-scale the Africa RISING approach to problem diagnosis and technology testing in respect of storage of cassava chips for export to Burundi.
3. We will link with HELVETAS Swiss Intercooperation to test the effectiveness and acceptance of different storage technologies for maize under small holder farmer conditions in the central corridor of Tanzania.
4. We will link with TFNC to develop communication strategies to increase awareness of aflatoxin bio-control of aflatoxin.
5. We will maintain the link with The National Steering Committee for Mycotoxins in Tanzania to collaborate with up-scale technologies for mycotoxin mitigation.
6. We will maintain the link with SUA and SUA-iAGRI for the PhD and MSc. Students.

***4.10 ACTIVITY SCHEDULE***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Activity** | **2014** | | | | **2015** | | | | | | | | | | | |
| **S** | **O** | **N** | **D** | **J** | **F** | **M** | **A** | **M** | **J** | **J** | **A** | **S** | **O** | **N** | **D** |
| Proposal development |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Establish village-level pilot processing & community training centers for processing, storage and preservation of grains, legumes and horticulture crops and livestock products (IITA) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Evaluation of improved postharvest technologies with men, women and youth farmers for enhanced adoption of technologies (IITA) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Estimate and validate the economic profitability of improved postharvest technologies (IITA) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Collect samples from farmer’s fields and stores in the project villages for analyses of mycotoxins and other grain quality parameters (IITA) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Train farmers/households in novel processing, products development (high nutrient diet formulation) and preservation of locally produced grains, legumes, horticulture crops (IITA) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Analyze samples for mycotoxins collected in August 2014 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Analyze mycotoxin in poultry feed rations (IITA) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Prepare and disseminate relevant training and information using relevant avenues (TFNC) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Support research and development platforms in Babati (IITA) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Follow up survey of knowledge, attitude and perception in response to mycotoxin media campaign (TFNC) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Data analysis and report as indicated for each activity above, plans for subsequent year (IITA) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

***4.11 BUDGET (USD) FOR 2014/2015***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***Items*** | ***Post-Harvest*** | ***Mycotoxin*** | ***TOTAL*** | ***Comments*** |
|
| **Personnel** |  |  |  |  |
| Coordination | 16,000 | 9,000 | 25,000 | Staff time (IRS – 0.1 FTE for post-harvest, and 0.05 FTE for mycotoxin) |
| Postharvest specialists/Associate professional experts (Field staff and other consultants) | 20,871 | 13,129 | 34,000 | 8% staff time for post- harvest and 50% of 2 staff for mycotoxin |
| **Operations** |  |  |  |  |
| Meetings for new partners’ and farmers in villages | 5,000 |  | 5,000 | Accommodation, meeting venues, DSA for partners |
| Establishment of pilot processing centers (Food processing and training sites) | 5,000 |  | 5,000 |  |
| Technology testing and demonstration (storage, drying, mechanized processing for Theme 4, and poultry feed for Theme 2) | 17,500 | 4,000 | 21,500 | (1) Processing equipment, Instruments and training. (2) Follow-up and monitoring of the testing of technologies to establish their influence on mycotoxin contamination |
| Communication strategies to increase awareness of mycotoxins and their management |  | 8,000 | 8,000 | To be led by and sub-contracted to TFNC |
| Sample collection, preparation and analysis for mycotoxin |  | 13,000 | 9,000 | Sample collection and processing; and chemical supplies for mycotoxin analysis and laboratory fees in IITA Science Building |
| Training, Data collection, | 5,000 |  | 5,000 | Partner- DAICOs, SUA, NGOs, etc. |
| Office supplies, stationery and communication |  | 3,000 | 3,000 | Supplies and utilities, stationeries, IT, phones, media contacts |
| **Travel** |  |  |  |  |
| Transport | 7,000 | 10,000 | 17,000 | Travel expenses; Vehicle use and services |
| Partner funds | 10,000 |  | 10,000 |  |
| IITA Overhead | 0 | 0 | 0 |  |
| **Sub-total** | **86,371** | **60,129** | **146,500** |  |

***4.12 PROJECTIONS FOR 2016***

* Expand project site from the current 6 to 9 villages in Babati.
* Scale up the technology to cover 180 farmers in Babati.
* Establish more pilot centers from 3 to centers.
* Publish at least 2 research papers in international journals.
* Evaluate efficacy of a Tanzanian biocontrol product together with other post-harvest management methods to reduce aflatoxin concentration in crops.
* Continue to promote technologies and scale out to other villages and districts and acquire other technologies for validation.

## Theme 5. Management of maize lethal necrosis disease

***5.1 RESEARCH TEAM (Theme leader: Jumbo Bright, CIMMYT, Lava Kumar, IITA)***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Name | Gender | Institution | Job title | Disciplinary expertise | Highest qualification | Project role | % time commitment |
| Bright Jumbo | M | CIMMYT | Scientist | Breeding | PhD | PI | 25% |
| Dan Makumbi | M | CIMMYT | Senior Scientist | Breeding | PhD | Co-PI | 10% |
| NN | M | CIMMYT | Senior Scientist | Pathology | PhD | Staff | 10% |
| Lava Kumar | M | IITA | Scientist | Virology | PhD | PI | 5% |
| AllanMereki | M | IITA/UM/MAFSC | Postgraduate student | Virology | MSc (in progress) | Student | 80% |
| Susan Njeri | F | CIMMYT | Research Assistant | Breeding | MSc | Field Operations | 10% |
| George Ochieng | M | CIMMYT | Research Assistant | Breeding | Diploma | Field Operations | 10% |
| Kheri Kitenge | M | SARI | Scientist | Breeder | MSc | Research operations | 10% |

***5.2 SUMMARY***

The outbreak and rapid spread of Maize Letheal Necrosis (MLN) disease in Tanzania, especially in Arusha, Babati, Mara and Mwanza, have emerged as a big threat to maize production and currently most of the commercially available varieties are susceptible to the disease. With the support of AfricaRISING, efforts are in progress since 2012-13 to develop varieties resistant to MLN and understand MLN epidemiology to develop suitable integrated solutions to manage MLN threat. Some promising hybrids identified during these efforts which include J4-134, J4-238, J4-188, J4-172, J4-241, J4-179, J4-20, J4-1, J4-34, J4-25, J4-56, J4-3, J4-103, J4-14, J4-106, J4-51, J4-87, J4-81, J4-84, J4-26, J4-117, J4-21, J4-120, J4-50, J4-109, J4-44, J4-22, J4-115, J4-123, J4-125, J4-42, J4-23, J4-83, J4-31, J5-106, J5-6, J5-41, J5-79, J5-73, J5-27, J5-90, J5-107, J5-75, J5-102, J5-65, J5-78, J5-112, J5-32, J5-111, J5-105, J5-4, J5-108, J5-38, J5-12, J5-34, J5-68, J5-28, J5-9, J5-37, J5-100, J5-5, J5-48, J5-3, J5-98, J5-18, J5-55, J5-59, J5-29, J5-46, J5-22, J5-13, J5-117, J5-64, J5-104, J5-39, J5-17, J5-7, J5-76, J5-2, J5-67, J5-116, J5-63, J5-1, J5-91, J5-53, J5-40, J5-89, J5-115, J5-15, J5-25, J5-47 and J5-36 need to be tested to validate their response to MLN in the disease hotspot areas under different agronomic and cultural practices. Epidemiological surveys are required to assess the disease incidence during the off-season and its impact on new season crop. Studies are also required to understand the key biophysical characters influencing MLN epidemics in the region. Low-cost MLN diagnostic tools developed in the previous efforts need to be extended to the stakeholders, which requires investing in building local laboratory capacity and training personnel in diagnostics and analysis.

***5.3 RESEARCH PROBLEM AND JUSTIFICATION***

During execution of Africa RISING activities in Babati in 2013, we identified symptoms of MLN disease in the trials and noted that many of the recently released hybrids and the commercial checks were seriously affected by the disease. Although the varieties preferred by farmers expressed moderate symptoms earlier on, their response has not been consistent in the subsequent season under uniform disease pressure. Pest and disease surveys organized by IITA and partners revealed a severe MLN incidence in low and mid-altitudes compared to high altitudes. Plants affected at early stage of the plant growth died prematurely, resulting in a 100% yield losses. Studies also revealed relatively high incidence of single infection of MCMV compared to mixed infection of MCMV+SCMV suggesting that MCMV alone is a threat to maize.

The most sustainable control option for MLN is host plant resistance combined with other management options such as good cultural practices. CIMMYT together with its partners from both private and public research organizations have teamed up to work on finding solutions to control MLN. Initial evaluations of several maize inbred lines and hybrids for resistance/tolerance in Kenya have led to the identification of some hybrids and inbred lines with moderate resistance and tolerance to the disease under natural and artificial inoculation (CIMMYT, 2012). Several of these hybrids, including farmer preferred hybrids selected during agronomic evaluations in Babati in year 2 (2012) have been tested in 2013/14 crop growing season for their reaction to MLN under natural infestation in hotspot areas. Best performing hybrids included the following experimental hybrids: J4-134, J4-238, J4-188, J4-172, J4-241, J4-179, J4-20, J4-1, J4-34, J4-25, J4-56, J4-3, J4-103, J4-14, J4-106, J4-51, J4-87, J4-81, J4-84, J4-26, J4-117, J4-21, J4-120, J4-50, J4-109, J4-44, J4-22, J4-115, J4-123, J4-125, J4-42, J4-23, J4-83, J4-31, J5-106, J5-6, J5-41, J5-79, J5-73, J5-27, J5-90, J5-107, J5-75, J5-102, J5-65, J5-78, J5-112, J5-32, J5-111, J5-105, J5-4, J5-108, J5-38, J5-12, J5-34, J5-68, J5-28, J5-9, J5-37, J5-100, J5-5, J5-48, J5-3, J5-98, J5-18, J5-55, J5-59, J5-29, J5-46, J5-22, J5-13, J5-117, J5-64, J5-104, J5-39, J5-17, J5-7, J5-76, J5-2, J5-67, J5-116, J5-63, J5-1, J5-91, J5-53, J5-40, J5-89, J5-115, J5-15, J5-25, J5-47 and J5-36. Considering high variability of disease pressure under natural infestation, it is important that top performing hybrids selected from the 2013/2014 growing season are validated to confirm results.

Variations in planting time observed in farmers’ fields in Kenya as well as in Babati have shown that maize crop under delayed planting has often been severely affected by MLN. In view of this, we believe good cultural practices, including timely planting would significantly support other control measures to manage this disease and, therefore, needs to be investigated. Experiments will be organized to understand the key biophysical factors influencing the MLN incidence, especially in the late sown crops.

Accurate diagnosis of MLN viruses is essential to understand the host response, surveys and epidemiological studies. In 2012-13, IITA developed low-cost diagnostic tools for the detection of MCMV and MLN casual viruses. Efforts are being made to establish MLN diagnostic lab in Selian Agriculture Research Institute (SARI), Arusha, Tanzania, to backstop regional activities. Sustainability of project outputs on MLN is very desirable and requires core activities including strengthening stakeholder capacity through training on detection and identification of MLN causing viruses, upgrading available laboratory with suitable equipment for analysis of samples. It is therefore imperative that national laboratory is equipped with necessary facilities for analysis and personnel trained on analysis and diagnostic skills.

***5.4 RESEARCH OBJECTIVES***

1. To identify MLN resistant varieties from available commercial, farmers and experimental maize varieties grown under high disease pressure.
2. Assess the effectiveness of different disease management options (cultural practices) in reducing the incidence of MLN for recommendation in target maize growing areas.
3. Establish the prevalence of MLN and identify causative virus strains sampled from diseased maize plants in Africa RISING research sites in Babati.
4. Determine key biophysical factors of MLN epidemiology
5. Develop capacity for diagnosis of MLN viruses (equipping diagnostic lab and training course for relevant staff).

***5.5 METHODOLOGY***

1. For objective 1, we plan to set up a trial composed of 150 top performing selected from the 2013/2014 evaluation. The entries in this trial will be the top performing hybrids selected from the 2013/2014 evaluations in Babati. The trials will be planted at 4-5 hotspot locations (Manyara Farm, Seloto and Sabilo) in Babati district under natural infestation. The hot spot areas in Babati have high disease pressure as three of our 2012/13 season trials planted at three of these areas were completely lost to MLN. These hotspot locations were identified during our regular visits in Babati district and during a survey on MLN conducted in 2012 in Tanzania. The experimental design to be used will be the alpha lattice design. Data will be collected on plant stand count, grain yield, days to 50% anthesis and silking, MLN disease severity (scale 1-5, with 1=no disease and 5=100% death due to disease) and MLN disease incidence based on symptoms and diagnostic tests. Data on disease incidence and severity will be recorded at three-week intervals after planting until the end of the grain filling period.
2. Addressing objective 2, we plan to stagger planting, with the first planting done timely with the onset of rains and second planting two weeks after the recommended planting time. Similarly, data will be collected as described in objective 1. This is a follow up of the previous growing season.
3. For objective 3, we plan to conduct surveys in farmers’ fields around Babati to establish the prevalence of the disease, aiming at developing high density MLN distribution, incidence and severity map. Survey protocol established previously will be utilized for this purpose. This will be done two weeks from the time of planting with subsequent monitoring periodically during the crop development till flowering stage. Samples will be taken from diseased plants for laboratory analysis to identify virus strains prevalent in these areas. This activity was not done last season.
4. For objective 4, we plan to determine the role of contiguous farming, off-season crops (maize grown using residual moisture), alternative hosts, vectors, and seed in the primary and secondary spread of MLN viruses. The Relationship between the MLN incidence and weather parameters collected from the 3 Africa RISING action sites in Babati will be investigated.
5. Objective 5 will involve streamlining the diagnostics operations in SARI, with necessary facilities for analysis which is currently in progress. This will be supported with training of 10 personnel on diagnostics skills. A student has already been engaged for this work.

***5.6 EXPECTED RESULTS/DELIVERABLES***

* Hybrids with resistance/tolerance to MLN are identified and recommendations made for their utilization: a) for inclusion in national performance trials for fast track release (experimental hybrids), and, b) for upscaling in MLN-affected areas (commercial hybrids).
* Knowledge and information on the prevalence of MLN in target maize based systems is established for utilization in formulating appropriate recommendations on management strategies, determining training needs and designing information packages for public awareness.
* Effective management options recommended for up scaling in target maize growing areas.
* High density map of MLN distribution, incidence and severity in Babati, in addition to the identification of virus strains associated with MLN in designing appropriate protocols for managing the disease in the target maize growing areas.
* Preliminary knowledge on critical factors influencing the MLN outbreaks in Babati, vital for establishing integrated measures for MLN control.
* Enhanced capacity for MLN diagnostics in the Manyara region in Tanzania, and availability of MLN diagnostics services for backstopping the MLN diagnostic activities in the region At least 10 partners from relevant NARS trained in MLN diagnostics and surveillance skills.
* At least one student (supported by iAgri) trained to MSc.

***5.7 OTHER DELIVERABLES***

**Capacity development**

* + Farmers trained on identification of MLN disease symptoms and management strategies.
  + Collaboration with other projects, especially with environmental modeling for weather data from different agro-ecological zones in Babati.
  + Collaboration will be established with SARI for execution of the trials and farmer preference studies, and DALDOs for farmer selection and training;
  + MLN diagnostics support lab at SARI.
  + Collaboration with ICIPE for identification of insect vectors
  + Collaboration with FAO on information exchange and engagement with broader regional coordination efforts on MLN management
  + Collaboration with ILRI on food-feed maize variety identification.
  + Collaboration with CIAT on identification of best performing maize hybrids under varying agronomic management options

**Academies, including publications, conference papers**

* Scientific publication(s) in refereed journal(s) and reference bulletins for extension agents and farmers.

***5.8 EXPECTED OUTCOMES***

**Short-term**

1. Information on awareness and management of MLN packaged, available and training delivered to stakeholders and farmers on, diagnostics, analysis, control and management of the disease.
2. MLN stress tolerant hybrids validated and included in national performance trials for variety release consideration.
3. Information on MLN distribution for targeted control efforts.
4. Epidemiology knowledge leading to integrated control strategies
5. MLN diagnostic support available in the region to all stakeholders, especially for testing germplasm and disease surveillance

**Long-term**

1. Seed of MLN disease tolerant improved maize variety is available to farmers in the Babati action areas.
2. Threat to food security due to MLN in maize growing areas in Tanzania arrested.

***5.9 LITERATURE REFERENCES***

Brandes, E.W. 1920. Artificial and insect transmission of sugarcane mosaic.*Journal of Agricultural Research* 19: 131-138.

CIMMYT, 2012. Maize lethal necrosis (MLN) disease in Kenya and Tanzania: Facts and actions.

Nault, L. R., W. E. Styer, M. E. Coffey, D. T. Gordon, L. S. Negi, and C. L. Niblett. 1978.Transmission of maize chlorotic mottle virus by Chrysomelid beetles. *Phytopathology* 68: 1071–1074.

Pemberton, C.E., L.J. Charpentier. 1969. Insect vectors of sugarcane virus diseases. In: Pests of Sugarcane. (Eds. Williams JR, Metcalfe JR, Mungomery RW, Mathers R), pp. 411-425.

Wangai A., M. G. Redinbaugh, Z. M. Kinyua, D. W. Miano, P. K. Leley, and M. Kasina, G. Mahuku, D. Jeffers. 2012. First Report of Maize chlorotic mottle virus and Maize Lethal Necrosis in Kenya. *Plant Disease* 96: 1582.

***5.10 ACTIVITY SCHEDULE***

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2014** | | | **2015** | | | | | | | | | | | | | **2016\*** | | | | | | |
| **Activity** | **Oct/Nov** | **Dec** | **Jan** | | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | | **Aug** | **Sep** |
| Pre-trial site stakeholder and inception meeting | X | X |  | |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |
| Seed multiplication for trials (done in advance using other resources, preparation & Shipment | X | X |  | |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |
| Land preparation and planting | X | X |  | |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |
| 1st monitoring visit and initial disease scoring, MLN surveys & trainings |  | X | X | |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |
| Topdressing of trials, MLN surveys |  |  | X | |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |
| 2nd monitoring visit and disease scoring, MLN survey |  |  | X | | X |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |
| Data collection (flowering, disease scoring feed quality), MLN survey |  |  |  | | X | X |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |
| 3rd monitoring visit |  |  |  | |  | X | X |  |  |  |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |
| Harvest maize |  |  |  | |  |  |  | X | X |  |  |  |  |  |  |  | |  |  |  |  |  |  | |  |  |
| Data analysis |  |  |  | |  |  |  |  |  | X | X |  |  |  |  |  | |  |  |  |  |  |  | |  |  |
| Report write-up and submission |  |  |  | |  |  |  |  |  |  |  | X |  |  |  |  | |  |  |  |  |  |  | |  |  |

\* Since activities of next year 2015/16 will based on results from 2014/2015, the scheduling for 2015/16 is left blank

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  | | --- | |  | | ***5.11 BUDGET 2014/15 (USD)*** | | **Line item** | | **Total cost IITA** | **Total cost CIMMYT** | **Comments** | | **Personnel** | |  |  |  | | Staff time | | 9000 | 15,000 | 5% for IITA; 25% for CIMMYT | | Research technician | | 11000 | 6,000 | Staff time | | Research consultants/Partners | | 3000 | 4,000 | Trial management and collaborative work (CIMMYT), Laboratory analysis of samples / resource person for field surveys (IITA) | | **Research Costs** | |  |  |  | | Seed production costs (hybrid seed-pollination costs-pollination bags, labor, irrigation costs, fertilizers) ,  Field trial set up, management (planting, weeding, fertilizers, harvesting, labor), data collection and field days | | 0 | 30,000 | This cost also includes seed production (7,000 which has already been committed for experimental hybrids production) | | Field surveys and virus diversity and mapping (objective 3) | | 10,000 | 0 | Surveys will be conducted together with the project team, especially SARI to develop local capacity monitor maize virus diseases.  Contagious surveys, from off-season to main season, in selected sites in Babati for tracking disease incidence and *inoculum* sources. This knowledge will advise on the value of Phytosanitation for MLN management. (Note this activity will be executed with carry over funds ca. $10,000).  Samples will be characterized for virus diversity. | | Epidemiological studies (objective 4) | | 8,000 | 0 | Cost of field trials, casual labour, seed material, minor field implements and irrigation, fertilizer and other materials. | | Strengthening of MLN diagnostics lab at SARI (objective 5) | | 4,000 | 0 | Lab supplies and other generic equipment upgrade | | Training in MLN diagnostics and surveillance (objective 5) | | 8,000 | 0 | Domestic travel, accommodation, per diem, venue, training course material | | Local and International travel | | 5000 | 5,000 | For CIMMYT and IITA staff to travel to Tanzania for monitoring of activities, data collection, field days and project meetings | | Vehicle costs | | 5000 | 3,000 | Hire vehicle or vehicle maintenance for in-country travel during field operations | | Office equipment and supplies | | 1500 | 2000 | Computer, printer consumables, stationery | | **Sub-total (Direct costs)** | | **64,500** | **65,000** |  | | Indirect costs (15%) | | 00 | 9,750 |  | | **Institutional totals** | | **64,500** | **74,750** |  | | **Theme Total** | | **139,250** | |  | |

***5.12 THEME LOGFRAME***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **ESA Master logframe component** | **Management of Maize Lethal Necrosis disease, logframe** | | | |
| **ESA Logframe Output**  **(Reference)** | **Theme Outputs:** | **Objectively verifiable indicators** | **Means/Source of Verification** | **Important assumptions** |
| **Research Output 2** Output 8 Innovations that address emerging agricultural production challenges deployed | Output 8.1: Integrated Maize Lethal Necrosis (MLN) disease management options validated and recommended for use:   * + 1. Top performing maize varieties validated for MLN resistance     2. Best bet agronomic and cultural practices validated and recommended for use     3. High density map for MLN distribution in Babati     4. Information on key epidemiological factors of MLN outbreak established     5. Information on virus strains associated with MLN in the target maize growing areas established & measures taken for designing appropriate protocols for managing the disease     6. A full functional ELISA-based lab established at SARI personnel from NARS trained in MLN diagnostics and surveillance | 8.1.1 Number of maize varieties validated for resistance to MLN resistance and recommended for national Performance Trials (NPT) inclusion  8.1.2 Number of best bet agronomic and cultural practices validated and recommended for use.  8.1.3 Available information on virus strains associated with MLN in the target maize growing areas.  8.1.4 Available high density map for MLN distribution in Babati  8.1.5 Available information on virus strains associated with MLN and measure taken for designing appropriate protocols for MLN management  8.1.6 Available and functional ELISA based lab established and number of personnel from NARs trained in MLN diagnostics and surveillance | 8.1.1 Field reports, government annual reports  8.1.2 Project reports, government reports  8.1.3 Project reports  8.1.4 Project reports  8.1.5 Project reports  8.1.6 Project reports, lab reports, training reports | 8.1.1 Availability of fields for testing, good rain season, good disease pressure, stable political environment  8.1.2 Availability of fields for testing, good rain season, good disease pressure, stable political environment  8.1.3 Disease occurrence  8.1.4 disease prevalence, conducive environment for disease outbreak  8.1.5 Disease occurrence  8.1.6. Support from SELIAN |
| **Activities** |  | **Milestones** | **Timeline** | **Lead Responsibilities** |
| 8.1.1 Validate performance of selected maize varieties for resistance to MLN  8.1.2 Validate agronomic and cultural practices as options for MLN management |  | Data on key traits collected and analyzed, and resistant/tolerant varieties validated by September, 2015  Data on key traits collected and analyzed, and effective MLN management options validated and recommendations made by September, 2015 | October 2014 to September 2015  October 2014 to September 2015 | CIMMYT |
| 8.1.3 Establish high density map of MLN distribution in Babati  8.1.4 Determine the key epidemiological factors of MLN outbreak  8.1.5 Identify virus strains associated with MLN, formulate measures and design appropriate protocols for managing the disease in the target maize growing areas.  8.1.6 Develop capacity for monitoring and diagnosis of maize viruses, including MLN |  | 8.1.3 Surveys during crop season [pre- (Nov-Dec) and post (May-Jun) main (Jan-April) crop season) completed by June 2015; analysis of survey samples for MLN viruses completed by July 2015; MLN distribution map developed by Aug 2015  8.1.4 By Dec 2015, organize trials in three agro-ecologies; monthly monitoring reports till harvest.  8.1.5 By Dec 2015, information on virus strains associated with MLN in the target maize growing areas established & measures taken for designing appropriate protocols for managing the disease  8.1.6 A full functional ELISA-based lab established at SARI by Jan 2015; 10 personnel from NARS trained in MLN diagnostics and surveillance | October 2014 to December 2015 | IITA |
|  |  |  |  |  |

## *5.13 FtF INDICATOR TARGETS FOR 2014/2015 AND 2015/16*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Level of Indicator** | **Indicator name** | **FtF indicator number** | **2014/2015 projections** | **2015/2016**  **Projections** |
| **Sub-Intermediate Result 1.1: Enhanced Human and Institutional Capacity Development for Increased Sustainable Agriculture Sector Productivity** | Number of farmers and others who have applied improved technologies or management practices as a result of USG assistance | 4.5.2-5 | 5 to 6 | 10 to 15 |
|  | Number of individuals who have received USG supported short-term agricultural sector productivity or food security training | 4.5.2-7 |  |  |
|  | Number of members of producer organizations and community based organizations receiving USG assistance | 4.5.2-27 |  |  |
| **Sub-Intermediate Result 1.2: Enhanced Technology Development, Dissemination, Management, and Innovation** | Number of hectares under improved technologies or management practices as a result of USG assistance | 4.5.2-2 | 4-5 | 10 |
|  | Number of new technologies or management practices in one of the following phases of development:  ...in Phase I: under research as a result of USG assistance | 4.5.2-39 | 5 | 5 |
|  | ...in Phase II: under field testing as a result of USG assistance |  | 5 | 5 |
|  | ...in Phase III: made available for transfer as a result of USG assistance |  | 3 | 3 |

## Theme 6. Institutional Cooperation and Co-Learning

***6.1 RESEARCH TEAM (Theme leader: Per Hillbur)***

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Name | Gender | Institution | Job title | Disciplinary expertise | Highest qualification | Project role/responsibility | % time commitment |
| Per Hillbur | M | Malmö University | Research Consultant | Human Geography | Associate Professor | Principal Investigator | 75 days |
| Semeni Ngozi | F | Egerton University | iAgri student | Agricultural Economics | MSc | Research Assistant | iAgri MSc 2014-2015 |
| Marco Sanka | M | Makerere University | iAgri  student | Agricultural Economics | MSc | Research Assistant | iAgri MSc 2014-2015 |

***6.2 SUMMARY AND JUSTIFICATION OF CROSS-CUTTING ACTIVITIES/OUTPUTS***

This part of the Babati proposal for 2014/15 and 2015/16 addresses research needs for integrating socio-economic and institutional issues to complement the strong agro-ecological focus in the Tanzanian sites of Africa RISING. It ranges from ongoing and planned activities for situation analysis and collection of socio-economic data to validate planned interventions in terms of social acceptability, integration of local knowledge and identification of proper impact pathways for the diffusion and scaling of innovations.

The first output “Target groups by typology” (indicators 2.2 and 9.1 in the ESA logframe attached) was completed this year for 600 households in the six villages to complement typologies suggested by WUR. In approaching the right target groups in research and scaling activities, the typologies should be known and integrated across the project as we move along the trajectory.

The second output “Established database for landscape/system analysis” (indicators 1.2, 2.1 and 4.1) builds upon compilation of available historical data on rainfall, hydrology and soil conservation measures, in combination with the ready available village profiles and village land use plans for Babati District. The database has a wide variety of uses from complementary situation analysis of resource flows at the systems landscape level to more hands-on activities, where the already negotiated village land use plans can be used as an entry point for village level “grassroot” platforms. This documentation will help in priority setting and link activities on the ground to the coordination and planning at the district level.

The third output “Functional R4D platforms at district and grassroots level” (indicators 4.1, 4.2 and 9.1) is well described elsewhere and is an ongoing, continuous activity from the establishment last year. The idea is to establish corresponding “grassroot level” platforms during 2015 to support impact and scaling on the ground. An essential feature of the R4D platforms is also that they are a vehicle for scaling activities within and beyond the district boundaries. The six villages represent different agro-ecologies, and the platforms are essential to promote scaling activities to the 90 villages in Babati that are not involved in the project at the moment. Scaling of this kind is beyond the budget of Africa RISING, and this is why it is a particular concern for the R4D platform and its stakeholders. If successful, the platforms at district and grassroots level may be seen as mature technologies that can be scaled out in 2016.

The fourth output “Effectiveness and efficiency in approaches” (indicators 7 and 9.1) was initiated last year, and two iAgri students will during 2014/15 conduct studies that evaluate and validate research approaches in terms of effectiveness and efficiency. One study is more general and will suggest “best-fit” approaches to different technologies (effectiveness and efficiency), while another will follow up our approaches to fertilizer application in maize/pigeon pea intercropping (efficiency). Both studies will inform future research and scaling activities in Africa RISING-Babati.

A general recommendation is that all scaling approaches are informed by the cross-cutting activities described here.

***6.3 ACTIVITY SCHEDULE*** (R=reports on activity, DR= Draft/midterm report, according to consultancy ToR)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| year | 14 | 14 | 14 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| month | O | N | D | J | F | M | A | M | J | J | A | S |
| Activity/output 1: Target groups by typology |  |  |  |  |  |  |  |  |  |  | DR | R |
| Activity/output 2: Established database for landscape/system analysis |  |  |  |  |  | DR |  |  |  |  | DR | R |
| Activity/output 3: Functional R4D platforms at district and grassroots level |  |  |  |  |  |  |  |  |  |  | DR | R |
| Activity/output 4: Effectiveness and efficiency in approaches |  |  |  |  |  |  |  | DR |  |  |  | R |
| Coordination of cross-cutting activities |  |  |  |  |  | DR |  |  |  |  | DR | R |
|  |  |  |  |  |  |  |  |  |  |  |  |  |

***6.4 BUDGET 2014/15***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | | | | **Reference to ESA Logframe** |
| **Activity/output 1: Target groups by typology** | | | | | **RO 1: Indicator 2.2**  **RO 3: Indicator 9.1**  Informs all AR Babati activities |
|  | **No.** | **Cost per item** | | **Total (USD)** |
| Principal investigator | 5 days | 400 | | 2,000 |
| International travel | 1 | 1,500 | | 1,500 |
| **Subtotal** |  |  | | **3,500** |  |
|  | | | | |  |
| **Activity/output 2: Established database for landscape/system analysis** | | | | | **RO1: Indicators 1.2, 2.1 and 4.1**  In collaboration with Kizito et al.  To inform platform activities |
|  | **No.** | **Cost per item** | | **Total** |
| Principal investigator | 35 days | 400 | | 14,000 |
| International travel | 1 | 1,500 | | 1,500 |
| Per diems | 20 days | 180 | | 3,600 |  |
| Allowance, interpreter | 20 days | 20 | | 400 |  |
| Local transport, vehicle | 20 days | 150 | | 3,000 |  |
|  |  |  | |  |  |
| **Subtotal** |  |  | | **22,500** |  |
|  |  |  | |  |  |
| **Activity/output 3: Functional R4D platforms at district and grassroots level** | | | | | **RO 1: Indicators 4.1 and 4.2**  **RO 3: Indicator 9.1**  Platform for all AR Babati activities |
|  | **No.** | | **Cost per item** | **Total** |
| Principal investigator | 30 days | | 400 | 12,000 |
| International travel | 2 | | 1,500 | 3,000 |
| Per diems | 20 days | | 180 | 3,600 |  |
| Allowance, interpreter | 20 days | | 20 | 400 |  |
| Local transport, vehicle | 20 days | | 150 | 3,000 |  |
| Platform meetings | 2 district;  3 grassroots | | 2,000  1,500 | 8,500 |  |
| **Subtotal** |  | |  | **30,500** |  |
|  |  | |  |  |  |
| **Activity/output 4: Effectiveness and efficiency in approaches** | | | | | **RO 2: several indicators, *e.g* 7.5**  **RO 3: Indicator 9.1**  Applies to several activities |
|  |  | **Cost per item** | | **Total** |
| *Personnel* |  |  | |  |
| Principal investigator | 5 days | 400 | | 2,000 |
| Fieldwork support to 2 MSc students  á 60 days | 2 students  (Ngozi, Sanka) | 2,500 | | 5,000 |  |
| **Subtotal** |  |  | | **7,000** |  |
| **Total** |  |  | | **63,500** |  |

***6.5 FTF INDICATOR TARGETS***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Indicator Title** | **Frequency of collection?** | **2013/2014 Achievements (if more than one data point)** | **Disaggregation** | **2014/15 Targets** | **2015/16 Targets** |
| Number of hectares under improved technologies or management practices as a result of USG assistance | annually | N/A | Sex: Male, Female | 0 | 0 |
| Number of farmers and others who have applied new technologies or management practices as a result of USG assistance | annually | N/A | Duration: New, Continuing Sex: Male, Female | 0 | 0 |
| Number of individuals who have received USG supported short-term agricultural sector productivity or food security training | annually | N/A | Type of individual: Producers, People in government, People in private sector firms, People in civil society  Sex: Male, Female | 0 | 0 |
| Number of food security private enterprises (for profit), producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) receiving USG assistance | annually | 1 | Type of organization (see indicator title for principal types) Duration: New, **Continuing** | 1 | 1 |
| Number of public-private partnerships formed as a result of FTF assistance | annually | 1 | Partnership Focus: Agriculture production, Agriculture post-harvest transformation, Nutrition, **Muliti-focus**, Other | 1 | 1 |
| Number of members of producer organizations and community based organizations receiving USG assistance | annually | 20 | Type of organization: Producer organization, Non-producer-organization CBO Sex: 6 Male, 9 Female | 20 | 20 |
| Number of private enterprises (for profit), producers organizations, water users associations, women's groups, trade and business associations, and community-based organizations (CBOs) that applied new technologies or management practices as a result of USG assistance | annually | 1 | Type of organization (see indicator title for principal types) Duration: New, **Continuing** | 1 | 1 |
| Number of new technologies or management practices in one of the following phases of development: …in Phase I: under research as a result of USG assistance …in Phase II: under field testing as a result of USG assistance …in Phase III: made available for transfer as a result of USG assistance | annually | 1 | Phase I: Phase II: Phase III: | 0 | 0 |